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ABSTRACT

The National Aeronautics and Space Administration's (NASA's) education vision is to promote excellence in America's education system through enhancing and expanding scientific and technological competence. In doing so, NASA strives to be recognized by the education community as the premier mission agency in support of the National Education Goals and in the development and implementation of education standards. To realize this vision, NASA has clearly defined and developed three specific goals to promote excellence in education. Specific objectives and milestones are defined for each goal in the body of this strategic plan. Goal 1: To maintain that segment of NASA's current education program that is judged to be effective, based on internal and external customer measures of success. Such maintenance involves individual program revision, expansion, or elimination. Goal 2: To implement new education reform initiatives which specifically address NASA mission requirements and national education reform. Goal 3: To significantly expand the impact of the NASA education program by developing partnerships with external constituencies. This plan also delineates three "enabling systems" which support all of NASA's education programs and contribute to the achievement of the goals. These are: evaluation, educational technology, and dissemination. In order to implement the strategy, four broad-based management priorities have been identified to guide the process of change. (Author/MKR)

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# NASA's Strategic Plan for Education

## A Strategy for Change: 1993-1998

First Edition, December 1992

EP-289

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# Table of Contents


Page

**Executive Summary** ..... 1
**Preface** ..... 5
**Background** ..... 7
**Strategy for Change** ..... 11
NASA's Education Vision ..... 11
Program Principles ..... 12
Maintaining Base Programs ..... 12
Elementary and Secondary ..... 13
Higher Education ..... 16
Reform Initiatives to Promote Excellence in Education ..... 19
Elementary and Secondary ..... 19
Higher Education ..... 26
Public Understanding of Science ..... 31
Strengthening Partnerships for Change ..... 32
Professional Education Associations ..... 32
National Aerospace Education Associations ..... 33
Industry ..... 33
Other Federal Agencies ..... 34
Enabling Systems ..... 34
Program Evaluation ..... 35
Educational Technology ..... 38
Dissemination ..... 40
**Management Priorities to Guide Change** ..... 43
**Conclusion** ..... 47
Acronyms ..... 49
Appendix A: Program Authority ..... 51
Appendix B: Education Division Organization Chart/ Office of Human Resources and Education ..... 53
Appendix C: The National Education Goals ..... 55
Appendix D: FCCSET/CEHR ..... 57
Appendix E: NASA Teacher Resource Center Network ..... 59
Appendix F: NASA Education Program and Information Dissemination Plan ..... 65

# Executive Summary

**NASA's Education Vision is:** *To promote excellence in America's education system through enhancing and expanding scientific and technological competence.*

In doing so, NASA strives to be recognized by the education community as the premier mission agency in support of the National Education Goals and in the development and implementation of education standards.

To realize this Vision, NASA has clearly defined and developed three specific goals to promote excellence in education. Specific objectives and milestones are defined for each goal in the body of this strategic plan.

**Goal 1:**
To maintain that segment of NASA's current education program—hereinafter referred to as the base or core program—that is judged to be effective, based on internal and external customer measures of success. Such maintenance involves individual program revision, expansion, or elimination.

**Goal 2:**
To implement new education reform initiatives which specifically address NASA mission requirements, national education reform, and FCCSET priorities.

**Goal 3:**
To significantly expand the impact of the NASA education program by developing partnerships with external constituencies.

This Plan also delineates three "enabling systems" which support all of NASA's education programs and contribute to the achievement of the goals.

**Evaluation**
Provides agency direction and plans to ensure documentation of program outcomes (both short term and long term).

**Educational Technology**
Outlines objectives to ensure that we maximize our limited resources and expand the delivery of programs and materials to the broadest possible audience through the appropriate use of educational technologies.

**Dissemination**
Provides a three-component systems approach to ensure that information and materials are known by and available to the broadest possible segment of the educational community.

In order to implement the strategy, four broad-based management priorities have been identified to guide the process of change:

1. To use "A Strategy for Change: 1993-1998" as a programmatic and management tool for developing a consensus direction for NASA's education program.
2. To implement an Agency program planning and budgetary process for the NASA Education Program and to transition from a support (functional management) approach to a program (operational) approach for planning, management, and budget.
3. To identify, articulate, and employ an integrated strategy to significantly increase ethnic and gender diversity in the science and technology pipeline.
4. To provide comprehensive staff development opportunities to ensure our employees and contractors have the proper knowledge and competencies to implement this strategic plan and reach NASA's Education Vision.

# NASA's Strategic Plan for Education
## A Strategy For Change: 1993-1998

| | |
|---|---|
| **Our Vision:** | To promote excellence in America's education system through enhancing and expanding scientific and technological competence |
| **Goals to Reach Our Vision** | 1) To review and maintain base<br>2) To implement new initiatives (education reform/FCCSET-CEHR)<br>3) To expand impact through partnerships |
| **Enabling Systems Supporting Each Goal** | • Evaluation<br>• Educational Technology<br>• Dissemination |
| **Management Priorities to Guide the Change Process** | • To use the Strategic Plan as a programmatic and management tool<br>• To implement an agencywide formal program planning and budgetary process<br>• To significantly increase ethnic and gender diversity<br>• To provide comprehensive staff development |

# Preface

It is NASA's policy to use its inspiring mission, its unique facilities, and its specialized workforce to conduct and facilitate science, mathematics, engineering, and technology education programs and activities.[1] These efforts are directed toward ensuring a sufficient talent pool to preserve NASA and U.S. leadership in aeronautics, space and Earth science, and technology and to help meet the National Education Goals. NASA's education efforts are implemented through two broad objectives:

a. Elementary and Secondary Level: To use NASA's mission to enhance the content knowledge, skills, and experience of teachers, to capture the interest of students, and to channel that interest into related career paths through the demonstration of integrated applications of science, mathematics, technology, and related subject matter.

b. Higher Education Level: To provide undergraduate and graduate student incentives and opportunities and to support faculty preparation and enhancement through programs featuring active participation in NASA research.

NASA's education program is implemented by a strong internal management structure with a clear direction for the future. Leadership and coordination of NASA's education program is the responsibility of the Associate Administrator for Human Resources and Education, reporting to the NASA Administrator. Within this office, the Education Division has Agency responsibility for policy development, management oversight, coordination, and direction of NASA's education program.[2] To ensure close coordination, communication, and sound management of education programs agencywide, each NASA Program Associate Administrator and each NASA Field Center Director has designated a single individual to serve as the focal point for that Office's or Field Center's education program.

## This Strategic Plan for Education:

- Establishes general Agency direction and guidance for the implementation and management of NASA's education programs for the next five years.
- Provides an ongoing process for targeting and re-directing NASA education programs in support of national education reform efforts, including the National Education Goals and the FCCSET/CEHR Strategic Objectives and Implementation Priorities.
- Provides an Agency strategy from which NASA Centers will each initiate a Center-specific education plan to provide a basis for Center program evaluation, direction, and resource analysis and formulation.

[1] *Appendix A contains the authority for this policy as derived from The National Aeronautics and Space Act of 1958, as amended*

[2] *Appendix B contains organization charts for the Education Division and the Office of Human Resources and Education*

- Provides a single, comprehensive Agency document which communicates NASA's goals and priorities to educational associations, aerospace education entities, NASA contractors, and other government agencies.

- Provides an internal communication and guidance document to NASA organizations and its employees.

# Background

NASA and the Nation's education system share the same goals—exploration, discovery, the pursuit of new knowledge—and achievement of those goals is interdependent. NASA depends on the U.S. education system to produce a skilled and knowledgeable workforce. The education community, in turn, uses the space program to motivate and encourage students to study science, mathematics, engineering, and technology and to offer students and educators unique research experience in those fields.

The release of "A Nation at Risk"[3] in 1983 gave rise to hundreds of studies pointing to the need for fundamental improvements in our educational system. During the same period, NASA's education program underwent similar scrutiny in response to increased demand on our programs by both NASA management and the education community. The number and variety of new initiatives reflect an unprecedented importance placed on education both within NASA and across the Nation. Our challenge is to meet the growing demands placed on NASA's education program, both by our internal and external customers, while maintaining an effective base of established programs and ensuring that our efforts are aligned with, and responsive to, the scope and direction of the national education reform efforts. As the Nation reassesses and reaffirms its commitment to education, so must NASA.

## National Education Goals

Implicit in improving the U.S. education system is the need for the Federal government, the private sector, and state and local governments to focus their efforts toward the accomplishment of a set of national education goals. In September 1989, the President met with the Nation's governors in Charlottesville, Virginia to discuss the education crisis. Various Department Secretaries and the NASA Administrator participated in this historic summit which outlined the National Education Goals.[4] These six goals include: enhancing student achievement and citizenship; making U.S. students first in the world in science and mathematics achievement; and advancing adult literacy and lifelong learning.

## FCCSET/CEHR

In order to define the role of the Federal government in the implementation of the National Education Goals as they relate to science, mathematics, engineering, and technology, the Science Advisor to the President formed an interagency committee of those Federal departments and agencies whose missions are dependent upon a highly skilled science, engineering, and technology workforce. The Committee on Education and Human Resources (CEHR) was established in 1990 and chartered under the Federal Coordinating Council on Science, Engineering, and Technology (FCCSET).[5] CEHR has developed a Federal strategy for science, mathematics,

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[3] *National Commission on Excellence in Education. A Nation At Risk: The Imperative for Educational Reform. Washington, DC: U.S. Department of Education, 1983.*

[4] *The National Education Goals are outlined in Appendix C.*

[5] *See Appendix D for FCCSET/CEHR membership.*



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engineering, and technology (SMET) education that will ensure U.S. world leadership in science and technology, build a highly trained workforce, and increase public understanding of science. The CEHR strategy delineates the following strategic objectives:

## FCCSET/CEHR Strategic Objectives

1. Improved science and mathematics performance;
2. Strong elementary and secondary teacher workforce;
3. Adequate pipeline for the science and technology workforce, including greater ethnic and gender diversity in science, mathematics, engineering, and technology education (e.g., African Americans, Hispanics, Native Americans, Pacific Islanders, women, and persons with disabilities); and
4. Improved public understanding of science.

Realizing fiscal constraints and the need to prioritize educational programs and activities at the Federal level, CEHR also established specific educational program implementation priorities. These implementation priorities address the FCCSET/CEHR strategic objectives and serve to guide NASA's education programs.[6]

## Elementary and Secondary Education Reform

National education reform cannot be realized through Federal commitment alone. Approximately 6% of the total spending for elementary and secondary education comes from Federal sources.[7] Most of the remainder is supplied by local and state governments. Therefore, reform of the education system must be led by local, state, and national education organizations, supported by local, state, and Federal governments, and ultimately, implemented by school administrators and classroom teachers.

There are two key components to effect elementary and secondary education reform.

**1. Standards.**
A number of national education organizations are developing a consensus on what students should know and what preservice teachers should be taught. The element common to all of these efforts is the establishment of standards: learning standards, teaching standards, and assessment standards.

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[6] *FCCSET/CEHR Implementation Priorities are outlined in Appendix D.*

[7] *FCCSET Committee on Education and Human Resources. By the Year 2000: First in the World. Washington, DC: Office of Science and Technology Policy, 1991, p 1.*

The Department of Education is playing a leading role in the elementary and secondary education reform effort. The Assistant Secretary of Education defined the need for standards:

> . . . We do not need a national curriculum to stimulate high achievement. **What we do need is clear consensus — standards** — in the different subject fields about what all children should know and be able to do. Standards define outcomes: for example, children of certain ages should understand the historical causes of major events, should be able to use mathematics to solve problems, and should understand basic scientific concepts. **The states themselves must decide the curriculum and policies that will produce those outcomes**. . . .[8]

The development of world class standards in mathematics has been completed by the National Council of Teachers of Mathematics (NCTM). Science standards are under development by the National Committee on Science Education Standards and Assessment in concert with the National Science Teachers Association. This process is being coordinated through the National Research Council, Coordinating Council for Education.

**2. Curriculum Frameworks.**
National education standards will become the basis from which states may develop curriculum frameworks (guidelines) in the various subject areas. Many states have already developed curriculum frameworks to support the NCTM mathematics standards. However, the task of developing national standards through consensus as well as state-by-state curriculum frameworks is a long and arduous one. NASA, in a supportive role, will seek out those organizations developing curriculum frameworks at the national and state level and provide linkage to the scientific, engineering, and educational expertise of the Field Centers. Once established, standards and the resultant curriculum frameworks will become the baseline for all of NASA's elementary and secondary education programs and materials.

## Higher Education Reform

There has been far less public attention to higher education than to the elementary and secondary level in the national debate over revitalization of science, mathematics, engineering, and technology education. Still, in recent years several studies and reports conclude with similar priorities.

While there are certainly important issues to be addressed in graduate education, reform oriented concern focused primarily on undergraduate education. Specifically, these reports address:

- the need for undergraduates to be actively involved in research experiences;
- the need for assigning introductory or survey courses that promote science literacy for all students;

[8] *Office of Educational Research. OERI Bulletin. Washington, DC. U.S. Department of Education, Winter 1991-92, p 2.*

- the need to recruit and retain persons who represent the diversity of the nation into science, engineering, and technology fields; and
- the need to achieve a better balance between the research and educational roles and responsibilities of science and engineering faculty.

Similarly, the 1994 FCCSET/CEHR Priority Framework lists the revitalization of undergraduate education (curriculum development and faculty enhancement) as a high priority.

U.S. graduate education, which is generally regarded as the best in the world, is the cornerstone of our research and development base. Therefore, although the need for revitalization at the graduate level may not seem as urgent, there are a number of issues that demand increased attention.

Graduate needs include:

- reversing the declining participation of U.S. citizens in science and engineering;
- reversing the declining Federal role in supporting graduate students; and
- restoring deteriorating facilities and equipment.

Within the context of these national concerns, NASA's University Affairs Officers have identified topics appropriate for increased emphasis by NASA. These program priorities form the framework from which the higher education objectives in this report were derived.

## Implications For NASA's Education Program

The urgent national need for education reform requires that NASA examine its education program *in toto*. No doubt this examination will dictate that some activities be eliminated and others expanded, redirected, or substantially revised. Change will require the broad participation of NASA Headquarters and Field Center personnel working with innovative educators across the country. Anticipating program redirection, the remainder of this plan describes the framework which will guide the necessary changes.

# Strategy for Change

**NASA's Education Vision**

Our ability to develop a succinct strategy for the NASA education program of the future is dependent upon our Education Vision. Simply stated, NASA's Education Vision is:

> *To promote excellence in America's education system through enhancing and expanding scientific and technological competence.*

In doing so, NASA strives to be recognized by the education community as the premier mission agency in support of the National Education Goals and in the development and implementation of education standards.

**To realize this Vision, we have clearly defined and developed three specific goals to promote excellence in education**

**Goal 1:**
To maintain that segment of NASA's current education program—hereinafter referred to as the base or core program—that is judged to be effective, based on internal and external customer measures of success. Such maintenance involves individual program revision, expansion, reduction, or elimination.

**Goal 2:**
To implement new education reform initiatives which specifically address NASA mission requirements, national education reform, and FCCSET priorities.

**Goal 3:**
To significantly expand the impact of the NASA education program by developing partnerships with external constituencies.

These three primary goals are identified to systematically guide NASA's education program toward its Vision. Each goal has several objectives and milestones to guide our actions. The highest priority, maintaining the base, seeks to review our current education programs and revise, expand, or delete such programs based on customer measures of success. Objectives cited under this goal, currently underway in most cases, are funded within the approved FY 1993 budget and subsequent fiscal year runouts.

The second priority addresses specific reform initiatives, directly related to the FCCSET/CEHR strategic plan and national education reform. Objectives supporting achievement of this goal are either planned for within projected budgets in FY 1994 or provide the basis for budget formulation in FY 1995 or beyond.

The third priority addresses the need to expand the impact of NASA's education program by strengthening partnerships with specific external constituencies. Again, objectives supporting achievement of this goal are either planned within the projected FY 1994 budget or provide the basis for budget formulation in FY 1995 or beyond.

Following the goals, this strategic plan delineates three enabling systems that support all three goals. The first enabling system, evaluation, provides agency direction and plans to ensure that both short term and long term program

outcomes are documented. Educational technology, the second enabling system, outlines objectives to ensure that we maximize our limited resources and expand the delivery of programs and materials to the broadest possible audience. The third enabling system, dissemination, provides a three-component system approach to ensure that information and materials are known by and available to the broadest possible segment of the education community.

## Program Principles

**In pursuing our Vision, all NASA education programs will adhere to the following principles**

**Primary:**

- NASA education programs will promote educational excellence.
- All education programs will demonstrate applications to and support of results-oriented, standards-based national education reform efforts, including the National Education Goals and the FCCSET/CEHR strategic objectives.
- Exemplifying ethnic and gender diversity, representatives of professional education organizations and external education constituencies will participate in the decision-making process for the design and implementation of NASA's education programs.

**Secondary:**

- Where feasible and warranted by program objectives, a database tracking system will be used to follow participants' educational and career choices.
- Mission-related research and development will be an integral component of all higher education programs. To the extent that they can be accommodated, students and faculty will spend time at NASA Centers.
- Where practical and beneficial, programs will be leveraged with funding or in-kind contributions of outside organizations.
- To the maximum extent, the Space Grant network will be utilized to help carry out appropriate program priorities.
- Evaluation and continuous improvement will be key components of all programs. Each program will have precisely worded and measurable objectives, based on customer measures of success.
- To the maximum extent, dissemination of education programs and materials will utilize state-of-the-art technology.
- Teacher enhancement programs will emphasize student-centered pedagogies; student programs will emphasize problem-solving and cooperative endeavors. Both will be supported by the skills, tools, and technologies necessary for those practices.

## Maintaining Base Programs

**Goal 1:**

To maintain that segment of NASA's current education program—hereinafter referred to as the base or core program—that is judged to be effective, based on internal and external customer measures of success. Such maintenance involves individual program revision, expansion, or elimination.

NASA offers a wide variety of base education programs to meet the myriad needs of educators and students from grade school through postdoctoral research. These programs are based on a solid and productive relationship with our customers and form the foundation of NASA's education program.

## Elementary and Secondary

At the elementary and secondary level, our education programs use NASA's mission to demonstrate the integrated applications of science, mathematics, technology, and related subject matter by expanding curricula and providing instructional opportunities for teachers and students.

NASA's national base program for elementary and secondary education includes: the Aerospace Education Services Program, teacher inservice workshops (e.g., NEWMAST, NEWEST, and Center-developed workshops); the Space Science Student Involvement Program; science and engineering fairs; school partnership programs; and the Summer High School Apprenticeship Research Program. These programs are administered through the NASA Field Centers.

***Objective:***

To review all elementary and secondary education programs to ensure that they support the National Education Goals; serve to maintain and, as necessary, expand the pool of scientists, engineers, and technicians; and provide incentives and opportunities for awareness and pursuit of careers as scientists, engineers, and technicians.

***Milestones:***

- Develop an accepted set of standards for program review based on accepted measures of success. (Completed)
- Review each national program using the accepted standards. (Underway)
- Review the evaluation results against the NASA Education Strategy and revise programs where indicated. (FY 1993)
- Initiate a review of elementary and secondary programs at the Field Centers. (FY 1993/1994)

***Objective:***

Establish Review Committees for all national programs.

***Milestones:***

- Establish Review Committees for all national base elementary and secondary education programs. Each committee will be comprised of representative customers and ethnically diverse groups and interests. (FY 1993)
- Review Committees will conduct program reviews and provide annual assessments beginning in FY 1994. (FY 1994)

*Objective:*
Strengthen the Aerospace Education Services Program through staff development activities including Center mission program support, educational technology utilization, and pedagogical principles and techniques.

*Milestones:*
- Design training program. (FY 1993)
- Establish training locations and conduct all aspects of training. (FY 1993-1994)
- Implement training results nationwide in school programs and inservice teacher workshops. (FY 1994-1997)

*Objective:*
Increase the annual participation in our teacher enhancement programs, including the NASA Educational Workshops for Elementary School Teachers (NEWEST), the NASA Educational Workshops for Mathematics, Science, and Technology Teachers (NEWMAST), and Center-sponsored inservice workshops.

*Milestones:*
- Determine alternative methods to increase participation. (FY 1993)
- Evaluate the programs for consistency in quality before and after expansion. (FY 1993 and FY 1994)
- Establish baseline data, including program characteristics, for Field Center teacher enhancement programs. (FY 1993)
- Make available Headquarters funding to increase participation in Center teacher enhancement programs. First priority will be those NASA Centers requesting funding; second priority will be Space Grant institutions. (FY 1994-1998)
- Include a pre-K component in the NEWEST program. (FY 1993-1994)
- Increase annual NEWEST and NEWMAST participation from 200 to 300 teachers. (FY 1994)

*Objective:*
Revise the Space Science Student Involvement Program (SSIP) to include components for the lower grades (3-12); to include problem-solving and teamwork concepts and activities; to feature mathematics and technology, as well as science; and to include activities at the secondary level to involve Moon/Mars expeditions and internship opportunities for Space Station Freedom, microgravity, wind tunnel, and supercomputer components.

*Milestones:*
- Expand participation to include all 50 states with special emphasis on urban areas and target populations. (FY 1993)
- Conduct four regional and four internship competitions and one national program to review winning proposals and present awards. (FY 1993)
- Award four additional internships. (FY 1994)



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***Objective:***
Expand the Summer High School Apprenticeship Research Program (SHARP) to all Field Centers and complete implementation of a database tracking system.

***Milestones:***
- Conduct SHARP at eight NASA Field Centers. (FY 1993)
- Conduct SHARP at nine NASA Field Centers. (FY 1994)
- Increase annual participation from 200 to 250 students. (FY 1995)
- Show current progress of all students who have participated in the program with particular attention to those who have been hired by NASA installations. (FY 1995)

***Objective:***
Conduct education workshops and conferences that focus on education issues, interdisciplinary activities, and teaching practices, using the NASA mission as a common theme.

***Milestone:***
- Conduct educator conferences and workshops each year that bring together educators and education leaders to highlight education issues and the NASA mission. Active participation of culturally diverse groups in all NASA education conferences will be emphasized. (FY 1993)

***Objective:***
Review NASA's current participation in local, state, and regional science and engineering fairs, National Engineers Week, and other engineering and technology programs.

***Milestones:***
- Develop an inventory of employee participation in such programs. (FY 1994)
- Establish baseline data for agencywide participation. Develop Agency strategy to equalize, maintain, or enhance participation in these programs where indicated. Strategy will also address agency reporting and tracking issues. (FY 1995)
- Implement strategy. (FY 1996)

***Objective:***
Review annually, and expand as warranted, NASA's preservice education programs.

***Milestones:***
- Identify Field Center preservice programs and activities. (FY 1993)
- Expand the Pre-Service Education Program to 12 higher education institutions. (FY 1993)
- Implement the Endeavour Fellowship Program for preservice teachers. (FY 1993)

- Expand the PreService Education Program to 40 higher education institutions. (FY 1997)
- Conduct national workshops periodically so that higher education institutions may disseminate approaches and materials used in the development of NASA-supported preservice programs. (FY 1994 and FY 1997)

***Objective:***
Determine current level of effort of NASA's partnership programs at HQ and Field Centers.

***Milestones:***
- In cooperation with the National Service Office, develop a process at Headquarters and at the Field Centers to recruit personnel interested in working with schools and students in the classroom. The process will include program guidelines and recommendations for training and materials support. (FY 1993)
- Develop an inventory of employee participation in such programs. (FY 1993)
- Establish baseline data for agencywide participation. Develop Agency strategy to equalize, maintain, or enhance partnership school programs where indicated by inventory. (FY 1994)
- Implement a feeder school strategy (to include at least one elementary, one middle, and one high school participant in each partnership) at each Field Center and Headquarters. (FY 1995)

## Higher Education

At the higher education level, NASA's programs provide student incentives and opportunities and support faculty preparation and enhancement through direct participation in research. The base program for higher education includes: The NASA/USRA Advanced Design Program; the Graduate Student Researchers Program, including the Underrepresented Minority Focus component; the Summer Faculty Fellowship Program; the National Space Grant College and Fellowship Program; and the JOint VEnture Program (JOVE). Specific modifications to these programs will be addressed in this plan or subsequent to planned program assessments. Programs are administered locally through a network of Center University Affairs Officers. The first objective in this section addresses the larger role these officials play in NASA's relationship with the higher education academic community.

***Objective:***
Strengthen the relationship between NASA and higher education institutions by:

a. providing, through the University Affairs Officers network, a central point of information and access for academic personnel;

b. monitoring issues of significant concern to the academic community; and

c. developing or supporting mechanisms to facilitate access to and communication with NASA.

***Milestones:***
- Publish and distribute a "user's manual" for the higher education community. (FY 1993)

- Update and modernize the University Management Information System. The data will become the source for reports and responses to ad hoc inquiries. (FY 1993)[9]
- Fund one or more Special Faculty Fellowships to analyze and make recommendations regarding concerns of the higher education community as they relate to the education of engineers and scientists. (FY 1994 )
- Maintain comprehensive knowledge of programs, activities, and resources and serve as first point of contact for university personnel without other NASA affiliation. (FY 1993 and continuing)
- The National Space Grant College and Fellowship Program network will develop mechanisms and systems to provide NASA linkages and serve as liaison to the academic community within each state, particularly those geographically remote from NASA Field Centers. (FY 1993 and continuing)
- Explore the development and implementation of systems to facilitate, enhance, and expedite NASA/university interaction (e.g., electronic communications technology for proposal development, submission, review and award processes.) (FY 1994 and continuing)

***Objective:***

Evaluate the Graduate Student Researchers Program.

***Milestones:***

- Implement database. (FY 1993)
- Conduct a comprehensive evaluation of the Graduate Student Researchers Program to determine customer measures of success, including: graduation/completion rates, ethnic and gender characteristics, reasons for non-completion, appropriate mix of disciplines (in cooperation with program offices and centers), adequacy of stipend, value of Center experience, quality of advisors and NASA colleagues, immediate career moves of those who graduate. (FY 1994)
- Initiate appropriate revisions as dictated by the evaluation. (FY 1996)

***Objective:***

Define, develop, and implement the strategic five-year program plan for the National Space Grant College and Fellowship Program.

***Milestones:***

- Evaluate the draft plan developed by Space Grant Directors Council. (FY 1993)
- Obtain input from program offices, Centers, and Space Grant Review Panel. (FY 1993)
- Finalize plan and develop five-year implementation schedule. (FY 1993)

[9] See p. 55, Program Evaluation

- Develop, with University Affairs Officers, individual Center roles and responsibilities. (FY 1994)
- Oversee plan implementation. (FY 1994-1998)

***Objective:***
Assess the progress and effectiveness of the National Space Grant College and Fellowship Program.

***Milestones:***
- Convene a Space Grant Directors' strategic planning meeting. (Completed)
- Conduct a comprehensive five-year review for the National Space Grant College and Fellowship Program to include a review of Headquarters and Center program management as well as an evaluation of the performance of each consortium. (FY 1995)
- Determine program revisions and consortia recertification/decertification. (FY 1995)
- Implement and oversee program revisions based on evaluation findings. (FY 1996)
- Implement management changes based on evaluation findings. (FY 1996)

***Objective:***
Review the effectiveness of the National Research Council (NRC) Resident Research Associateship Program.

***Milestones:***
- Conduct a five-year review of the NRC Resident Research Associateship Program in accordance with measures of success to be determined by the Office of Space Science and Applications and the Office of Aeronautics and Space Technology. (Early FY 1997)
- In collaboration with the NRC, determine appropriate revisions in program administration and direction following review of the report. (Mid FY 1997)
- Initiate, oversee, and monitor program revisions. (Late FY 1997)

***Objective:***
Review the effectiveness of the NASA/USRA Advanced Design Program.

***Milestones:***
- Conduct a five-year review of the program in accordance with measures of success to be determined by the Office of Aeronautics and Space Technology (OAST) and the Office of Human Resources and Education. (FY 1994)
- In collaboration with USRA and OAST, determine appropriate revisions in program administration and direction following review of report. (FY 1994)
- Initiate, oversee, and monitor program revisions. (FY 1994)

The "base" is the foundation of NASA's education program. Although these programs have been extremely successful over the years, we recognize the need to review and evaluate their continuing relevance to the changing needs of students and educators.

Therefore, in addition to sustaining the base program, NASA will next address areas of additional need by augmenting existing programs and developing new ones that specifically support national education reform efforts. While the base program directly supports NASA mission requirements, NASA also supports broader education efforts to improve education nationwide. These efforts will become the basis for budget formulation in FY 1995 and beyond.

## Reform Initiatives To Promote Excellence In Education

**Goal 2:**
To implement new education reform initiatives which specifically address NASA mission requirements, national education reform, and FCCSET priorities.

Many of these reform initiatives provide the basis for budget formulation in FY 1995 and beyond. This section is divided in three categories:

- Elementary and Secondary
- Higher Education
- Public Understanding of Science

## Elementary and Secondary

At the elementary and secondary level, reform initiatives to promote excellence and equity in education are specifically targeted towards supporting local, state, and national efforts to achieve the National Education Goals, including support of state curriculum frameworks and national standards for teaching and assessment.

### General.

This category is included for program initiatives that contain reform activities and efforts that may not clearly fit under the teacher enhancement, curriculum, organization and systemic reform, or student opportunities and incentives categories that follow.

***Objective:***
Provide to Aerospace Education Services Program (AESP) specialists knowledge, skills, and experience for aligning presentations and programs with formats which cover current principles and practices in education reform.

***Milestones:***

- Design, develop, and conduct staff development programs for all AESP specialists to acquaint them with major aspects of education reform at the national, state, and local levels. Emphasize curriculum frameworks, standards for teaching, and performance assessment. (FY 1993-1994)
- Update training in two-year intervals. (FY 1996)

***Objective:***

Initiate a broad program of "Teaching From Space" to demonstrate that space exploration and research is an ideal context in which to generate educational benefits, learning situations, and opportunities for participatory science, mathematics, and technology. Note: many of the other objectives throughout this plan may be grouped under the theme "Teaching From Space."

***Milestones:***

- Conduct periodic national curriculum-based educational activities that engage students and teachers in some aspect of "Teaching From Space"—e.g., the Space Exposed Experiment Developed for Students (SEEDS), Ground Truth Studies, satellite data analysis, and Get-Away Special payloads.
  - —Identify and assess national activities. (FY 1994)
  - —Select program activity with necessary resources—e.g., lead Center, etc. (FY 1995)
  - —Conduct program. (FY 1996)
  - —Continue to plan for a Teacher-in-Space Space Shuttle flight opportunity until a decision is made to implement or cancel this program element.
  - —Enhance the educational components and academic content of the teaching plan. (Completed)
  - —Refine the management plan for the implementation of the national education program. (FY 1994)
  - —Continue Teacher-in-Space Designee's national education/public outreach activities, and keep current her knowledge of NASA mission and program developments. (Continuing)
  - —Refine existing Payload Integration Plan. (Continuing)
- Expand educational opportunities offered through the Johnson Space Center Education Working Group (EWG), in collaboration with the Education Division.
  - —Develop and implement the Flight Crew Operations Directorate (FCOD) Educational Initiative Operating Plan. (Completed)
  - —Establish a Detailed Supplemental Objective (DSO) to support educational activities onboard the Space Shuttle, including preflight training requirements. (Completed)
  - —Continue to develop the Liftoff to Learning videotape series to enhance curriculum content. (Continuing)
  - —Continue to develop printed materials to complement all electronic media educational products developed through the EWG. (Continuing)
  - —Develop and implement live lessons from the Orbiter when the proposed educational activities cannot be accomplished on the ground and the lesson objectives cannot be met with a simple live downlink or a postflight videotape. (Continuing)

- Establish an education plan with the Office of Space Flight to maximize the educational value of the Get Away Special (GAS) Small Self-Contained Payloads.
  - —Develop proposal guidelines (including costs) for educational institutions interested in developing and flying elementary, secondary, and higher education student experiments. (Completed)
  - —Disseminate guidelines nationally and announce opportunities for education-based GAS payloads. (FY 1993)
  - —Develop schedule and begin manifesting GAS payloads. (FY 1994-1997)
- Establish a long-range education plan for the continued use of the Shuttle Amateur Radio Experiment (SAREX) onboard future Space Shuttle missions.
  - —Identify guidelines (including costs) to expand the educational benefits of the SAREX payload (under the auspices of the SAREX Education Working Group). (Completed)
  - —Develop, print, and disseminate program information materials for educators. (FY 1993)
  - —Broaden the participant base through dissemination of program information (announcements of opportunity, etc.). (FY 1993)

***Objective:***

Develop, pilot test, and implement a comprehensive education plan, in cooperation with the Office of Space Science and Applications, Earth Systems Division, the Goddard Space Flight Center, and the Jet Propulsion Laboratory for educational programs and curriculum materials based upon Mission to Planet Earth.

***Milestones:***

- Develop a cooperative ground truth studies program for grades K-12, involving participation by scientists, educators, and students. (FY 1994)
- Implement the Space Technology Education Program (STEP) for classrooms to have direct readout capability from the NASA-developed, NOAA-operated meteorological satellites. (FY 1994)
- Study the feasibility of utilizing NASA Select and Spacelink to deliver a distance education course in Earth systems science for science teachers. Implement the course if feasible. (FY 1994-1995)
- Complete "Interactive NOVA: Earth,"a videodisc-based curriculum package in Earth systems science. (FY 1994)

**Teacher Enhancement.**

Immediate upgrading of the existing teacher workforce is necessary to improve student performance. NASA programs will focus on both subject content and pedagogical skills. These programs will meet accepted teaching standards,respond to ethnic and gender diversity, and expose teachers to curriculum standards, high quality instructional materials, and state-of-the-art disciplinary research and educational technologies. Teacher enhancement is NASA's highest priority in elementary and secondary education.

***Objective:***
Expand and create new mechanisms for tripling the number of teachers provided with high-quality, hands-on inservice experiences at Field Centers and non-center based sites by FY 1998.

***Milestones:***
- Through consultation with the Field Centers, develop a goal and strategy for significantly increasing NASA teacher enhancement opportunities as NASA's contribution to this CEHR strategic milestone. (FY 1993)
- In response to the above, provide inservice training opportunities for elementary and secondary teachers through varied approaches and mechanisms including workshops, classroom follow-up, and technological means. (FY 1995 and continuing)

***Objective:***
Increase the ethnic diversity in teacher programs by expanding the participation of teachers who are African American, Hispanic, Native American, or Pacific Islander in NASA's teacher enhancement programs.

***Milestones:***
- Establish benchmarks (from FY 1992 level of participation) by which future programs can be measured. (FY 1993)
- Increase level of participation in agency teacher enhancement activities by 50% over the baseline (FY 1992) level. (FY 1995)
- Increase level of participation in agency teacher enhancement activities by 100% over the baseline (FY 1992) level. (FY 1997)

***Objective:***
Increase participation of teachers from urban and rural school districts that enroll large numbers of educationally and economically disadvantaged youth.

***Milestones:***
- As part of each national education program, develop a strategy for recruiting teachers from programs in these target areas. (FY 1994)
- Develop baseline data for these target groups. (FY 1996)
- Quadruple participation from these areas. (FY 1998)

**Curriculum.**
NASA-sponsored curriculum enrichment materials for teachers will emphasize active student participation, strengthen problem-solving skills, and accommodate student diversity. They will incorporate educational technologies where appropriate.

***Objective:***
Develop supplemental educational materials which support and encompass curriculum and teaching standards consistent with frameworks and principles of education reform and reflective of ethnic and gender diversity.

***Milestones:***

- Coordinate supplementary curriculum development efforts among Headquarters and Field Centers. (FY 1994)
- Develop high quality education materials for use by all elementary and secondary classroom teachers. (FY 1993-1998)
- Draft, field test, revise, and implement an agencywide evaluation system for identifying needed curriculum materials and evaluating proposed materials. (FY 1994)
- Develop all agency supplemental education materials in conformance with curriculum standards and education reform frameworks, being sensitive to the ethnic and gender diversity of students and promoting problem-solving, hands-on approaches, critical thinking skills, cooperative learning strategies, and multiple intelligence strategies. (FY 1994)
- Disseminate these materials via agency dissemination systems and networks (i.e., NASA Select and NASA Spacelink). (FY 1995)

***Objective:***
Develop and modify out-of-school programs—e.g., after and before school programs, Saturday academies, summer institutes, museum and planetarium programs, etc., to coordinate and support formal school instruction.

***Milestone:***

- All out-of-school programs will be developed or revised to support school instruction programs in accordance with education reform standards as they exist. (FY 1995)

***Objective:***
Produce supplementary curriculum materials using software and multimedia products. Identify and disseminate technology-based curriculum software developed with NASA sponsorship through activities such as the Space Grant program. These software curricula packages may include: (1) computer-assisted instruction programs, (2) computer simulations, (3) databases, (4) videodiscs, (5) CD-ROM databases, (6) videotapes, and (7) multimedia systems.

Particular attention will be given to the production of mission-related programs. These programs will use a specific NASA mission as the theme for technology-based programs to demonstrate aerospace education principles which can be easily integrated into the curriculum. As an example, the Liftoff to Learning series of videotapes produced in conjunction with the Education Working Group of the

Johnson Space Center will be continued. Additionally, a multimedia program, Interactive NOVA: Earth, consisting of a videodisc with integrated computer software, will be produced on the subject of Earth Systems Sciences.

***Milestones:***

- Produce at least one Liftoff to Learning tape each year. (FY 1993/continuing)
- Complete "Interactive NOVA: Earth." (FY 1994)
- Submit "Interactive NOVA: Earth" for textbook adoption in all relevant states. (FY 1995)
- Product a biannual edition of Software for Aerospace Education. (FY 1995, 1997)

**Organization and Systemic Reform**

Nine percent of Federal elementary and secondary education resources are directed toward achieving effective systemic reform.[10] The major Federal program to catalyze systemic reform is the National Science Foundation's (NSF) Statewide Systemic Initiatives (SSI) program. This program enables NSF to work with states to structure systems that can deliver high quality science and mathematics education for all students. NASA's elementary and secondary programs implemented at the Field Centers will observe and support systemic reform efforts at the state and local levels.

***Objective:***

Continue to develop, implement, and support the Tri-State Education Initiative (TSEI) as an exemplary model for NASA's role in education reform. This multi-state, regional program is designed to serve as a demonstration model for smaller scale replication in other geographic areas.

***Milestones:***

- Develop a strategic plan for systemic change as a model in the TSEI. (FY 1993-1994)
- Involve FCCSET/CEHR agencies, other state and local government organizations, and private industry in TSEI activities. (FY 1993)
- Evaluate the progress of the TSEI in supporting the National Education Goals. (FY 1997)

***Objective:***

Explore and develop linkages between existing Field Center education programs and states receiving NSF funding for SSI. These linkages should include elementary, secondary, and higher education programs.

***Milestones:***

- Two Field Centers will support selected states within their region that are receiving NSF funding for SSI. (FY 1993)

[10] *Report of the FCCSET/CEHR Working Group on PreK-12 Education. May 15, 1992.*

- Five Field Centers will support selected states within their region that are receiving NSF funding for SSI. (FY 1995)
- All Field Centers will support selected states within their region that are receiving NSF funding for SSI. (FY 1997)

***Objective:***
Ensure that all elementary and secondary programs and activities comply with state and local guidelines and frameworks in order to contribute to systemic change.

***Milestones:***
- Inventory all elementary and secondary agency programs that support and promote systemic change. (FY 1995)
- Update inventory of these programs as they exist. (FY 1997)

**Student Incentives and Opportunities.**
The Federal agencies' efforts to support out-of-school experiences that provide learning opportunities for students beyond those available in school classrooms amounted to 7% of the FY 1992 budget for elementary and secondary education.[11] These experiences and opportunities included partnerships, award programs, and other programs conducted in museums, science and technology centers, and media and community-based organizations coupled with classroom learning opportunities. At the elementary level, NASA education programs will emphasize activities to capture students' interest in science, mathematics, and technology. Programs for secondary students will emphasize participatory experiences to channel their interest into related studies and careers.

***Objective:***
Increase the number of students served through internships, mentorships, apprenticeships, and summer research programs by increasing the capacity to provide such experiences through partnerships and interagency cooperation and collaboration. It is assumed that the Centers are currently at capacity.

***Milestones:***
- Expand the capacity for student incentive and opportunity programs by 5%. (FY 1995)
- Expand the capacity for student incentive and opportunity programs by 15%. (FY 1997)

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[11] *Report of the ECCSET/CEHR Working Group on PreK-12 Education. May 15, 1992*

*Objective:*
Implement a nationwide career awareness program for students in grades 4-6 in cooperation with the American Counseling Association (ACA).

*Milestone:*
- Complete the development of the program and support the training of teachers and counselors to implement the program in all 50 states and the District of Columbia. (FY 1993-1994)

*Objective:*
Work with a national education organization to establish a culturally-diverse apprenticeship research program for secondary students in locations beyond the commuting distances to the Field Centers.

*Milestones:*
- Seek the cooperation of a suitable organization to form a partnership to design a non-Field Center based apprenticeship research program. (FY 1993)
- Develop the program. (FY 1994)
- Implement the program. (FY 1995-1997)

## Higher Education

At the higher education level, initiatives will focus on expanding access to research opportunities for both individuals and institutions. We will place greater emphasis on research opportunities for undergraduate students and individuals who are African American, Hispanic, Native American, Pacific Islander, female, or disabled. At the institutional level, two-year colleges are an important segment of the education pipeline for scientists, engineers, and elementary and secondary mathematics, science, and technology educators. Moreover, these institutions play an important role in training technicians and increasing the scientific literacy of their students, regardless of academic major. NASA's programs will stimulate stronger linkages between two-year colleges, upper-division undergraduate sectors, and the communities they serve.

**Institutional Development.**
Seek to broaden, through wider inclusion and capability building activities and programs, the base of institutions and individuals with which NASA interacts.

*Objective:*
Initiate programs and activities that broaden the base of institutions with which NASA conducts research and education activities. Particular emphasis will be on the inclusion of community colleges, Historically Black Colleges and Universities (HBCUs), Other Minority Universities, and institutions which have had little or no research support from NASA.

*Objectives specific to community colleges are:*
Enhance the preparation of community college students and increase the percentage going on to science and engineering majors in four-year institutions.

Continue to emphasize two-year associate degree programs oriented to providing technicians for NASA and related aerospace organizations with attention given to local market demands.

Utilize the community college system as a means of reaching African American, Hispanic, Native American, Pacific Islander, disabled, returning, part-time, and economically disadvantaged students.

Utilize the community outreach capabilities of the community college system as a mechanism for creating adult cognizance of NASA programs and activities.

***Milestones:***

- Conduct a needs assessment survey; acquire and analyze information from community college students, faculty, and administrators about issues unique to community colleges. This analysis will aid in the development of pilot programs and activities to achieve community college objectives. (FY 1994)
- Initiate projects based on information gleaned from the community college needs assessment survey. These projects will be initiated and implemented largely through Field Centers and Space Grant institutions to ensure that local needs are served and networks effectively exploited. (FY 1994-1998)

  The following list is illustrative:

  — Implement summer intern program and year-round activities (e.g., shadowing, apprenticing, consulting) that use or involve scientists and engineers at NASA Field Centers.

  — Integrate community college faculty into faculty enhancing programs (e.g., JOVE and the Summer Faculty Fellowship Program).

  — Sponsor classroom projects and demonstrations and provide data, models, etc. for classroom use.

  — Encourage and support articulation and joint admissions programs that facilitate the transfer of community college students to four-year institutions through incentives in the Space Grant program.

  — Encourage and support faculty exchange and collaboration programs between two- and four-year institutions, primarily through Space Grant.

  — Initiate scholarship programs, both for high school students applying to community colleges and for community college students applying to four-year institutions.

  — Support satellite-transmitted courses to geographically dispersed institutions.

***Objectives specific to other institutions are:***

Seek, through programs such as JOVE and Space Grant, to help develop the research capabilities of institutions and states not currently involved in NASA programs.

***Milestones:***

- Implement projects to help develop the research capabilities of institutions and states not currently involved in NASA programs. (FY 1993-1998)
- Sponsor research infrastructure building workshops (e.g., proposal writing).
- Sponsor bidders' conference for program office opportunities appropriate to developing institutions.
- Support MU-SPIN type of information and matching database for Federal research community.
- Work through the EPSCoR Interagency Coordinating Committee to leverage and maximize other "EPSCoR" programs to full effect.
- Sponsor workshops, seminars, and programs that enable faculty from developing institutions to network with NASA and other faculty from research-intensive institutions.

**Faculty Enhancement.**

Teaching faculty, especially faculty concerned with freshmen and sophomores, are central to the success of undergraduate education in science, mathematics, engineering, and technology. They must be proficient in state-of-the art technology and instrumentation, new experimental methods, and emerging pedagogical techniques. NASA will expand its programs to provide research-related experiences at university, Federal, and industrial laboratories for undergraduate faculty involved in teaching science, mathematics, engineering, and technology.

***Objective:***

Expand opportunities and activities that enhance faculty preparation for undergraduate teaching through adaptation of existing programs. These opportunities will expose faculty to advances in research, technology, instrumentation, experimental methods, and in how to transfer this knowledge in the classroom.

***Milestones:***

**Space Grant College and Fellowship Program**

- Announce funding incentives to encourage and support collaborative research opportunities through the National Space Grant College and Fellowship Program basic grants. (FY 1994)

**Summer Faculty Fellowship Program**

- Conduct comprehensive evaluation of the Summer Faculty Fellowship Program, with particular emphasis on the program's impact on undergraduate education (course development/revision, especially documentation of same). (FY 1993)
- Conduct statistical analysis of participation by type of institution (e.g., community college, undergraduate institution, research-intensive institution). Establish goals and timetables based on this analysis in order to increase emphasis on undergraduate education. (FY 1993)
- Begin implementation of above timetable to increase participation of two- and four-year institutions. Initiate system to monitor and assess impact on undergraduate education. (FY 1994)

- Continue phased implementation, monitoring, and assessment; adjust appropriately and perform comprehensive evaluation at end of 1997. (FY 1994-1997)

**Curriculum.**

**Model courses, units, and curricula in mathematics, science, engineering, and technology must be developed for the effective education of all students at all levels. At higher education levels, curricula must keep pace with the ever-expanding wealth of knowledge discovered through research. NASA will facilitate, promote, and support the development, documentation, and dissemination of research-based undergraduate courses and curricula.**

***Objective:***

**Encourage and support the development of effective, research-based undergraduate courses, curricula, and materials in science, mathematics, engineering, and technology. This material will: (1) provide strong disciplinary and cross-disciplinary training to science and engineering majors; and (2) advance the technical literacy of non-science and engineering majors.**

***Milestones:***

- Conduct literature search on undergraduate curriculum reform issues in order to better evaluate proposals and focus efforts. (FY 1994)
- Perform survey or research current survey materials regarding employers' perceptions of preparation adequacy of BS degree holders for work in aerospace fields. (FY 1994)
- Based on this analysis, initiate program through the National Space Grant College and Fellowship Program:
  - —Conduct an analysis of the national balance of activities mandated by Space Grant. This analysis should suggest consortia to focus on curriculum development. This effort will be monitored by a NASA Field Center to be tasked with this priority. (FY 1994)
  - —Initiate a topical consortium on undergraduate education. Conduct competition among Space Grant schools for supplemental grants funding release time to develop, pilot, test, evaluate, and disseminate effective curricula, materials, and instructional methods. (FY 1995)
  - —Establish Space Grant Initiatives (e.g., the Undergraduate Centers of Excellence). (FY 1996)
- Issue a number of research and development follow-on grants to Center-based research fellows to design courses based on their summer research (Summer Faculty Fellowship Program third year grants). (FY 1994)
- Document effective senior design courses for dissemination through the Advanced Design Program. Sustaining universities will be required to develop courses and curricula, sometimes as part of a collaborative effort with new participants. (FY 1996)

- Develop a means for disseminating curricula to the broader higher education community through the JOVE program, concentrated at undergraduate institutions. (FY 1996)
- Stimulate the development of general education courses for non-science/non-technical majors (survey courses). (FY 1996)
- Support curriculum development and reform through support of studies and task forces on undergraduate science and engineering education (e.g., National Research Council Board on Engineering Education studies on recruiting women/improving retention rates in undergraduate engineering). (FY 1993 and continuing)

**Student Opportunities.**

At the graduate level, a significant share of NASA's funding for science, mathematics, engineering and technology education goes to direct support for students. Programs geared toward increasing the participation of African Americans, Hispanics, Native Americans, Pacific Islanders, women, and persons with disabilities will be expanded. At the graduate level, NASA concentrates its resources on disciplines which are directly applicable to the agency mission; these resources, for pre- and postdoctoral programs, offer financial support and student research opportunities.

NASA's support for graduate education is well-established as part of our base education program. In addition to sustaining our commitment to graduate education, we will focus new efforts on increasing opportunities for undergraduates to participate in research and supporting undergraduate scholarships and internships.

***Objective:***

Broaden direct participation in the aeronautics and space program by providing increased support, incentives, and opportunities to undergraduates.

***Milestones:***

- Develop an undergraduate scholarship and/or summer internship program, administered by various Field Centers or by Space Grant Consortia, using the best features of current programs to form a model program. (Limit to students who have completed freshman year and who have declared majors in mathematics, science, and engineering.) (FY 1995)
- Initiate the Undergraduate Scholarship/Internship Program. (FY 1994)
- Explore linkages with Space Grant Consortia, Land and Sea Grant Programs, JOVE program affiliates, NSF/EPSCoR, SHARP, Co-op, other Federal programs, and National Scholars Program. (FY 1994)
- Cultivate summer internship positions at Centers for the Commercial Development of Space, University Space Engineering Research Centers, and Minority Research Centers as well as NASA Centers. (FY 1995)
- Expand by 50% the Undergraduate Scholarship/Internship Program. (FY 1997)



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*Objective:*
Oversee the implementation of NASA's University Space Initiative.

*Milestones:*
- Publish program brochure. (FY 1993)
- Coordinate and monitor component programs. (FY 1994-1998)
- Evaluate programs. (FY 1998)

## Public Understanding of Science

To ensure our global competitiveness, the U.S. must have scientifically literate citizens capable of understanding complex economic, political, ethical, and social issues derived from an increasingly technological society. Moreover, a scientifically literate public will understand the need for a robust research enterprise and will encourage and motivate our youth to study mathematics and science. Without this encouragement the science education efforts of the Federal government will be less effective. NASA is strengthening its programs to increase public understanding of science in order to satisfy the emerging science literacy standards.

NASA's largest contribution to the public understanding of science is through the NASA Visitor Information Centers. The centers, located at each NASA facility, offer the general public insight into the highly technological and scientific world of the Nation's civilian aerospace program. Significant new efforts at the Langley Research Center (Virginia Air and Space Museum) and the Johnson Space Center (Space Center Houston) complement existing efforts at all other NASA Centers to broaden their outreach and to enrich the experience of visitors to the NASA Visitor Information Centers.

The Education Division will work closely with the Public Affairs Office to define a public affairs plan to support this strategic plan. The public affairs plan will place special emphasis on efforts to enhance public understanding of science and will support the CEHR plan for this area.

*Objective:*
To reach out to communities, using the civilian aerospace program to elevate public science literacy.

*Milestones:*
- Develop a Public Affairs Plan for Education. (FY 1993)
- Establish a limited program and corresponding budget for Informal Science Education in consultation with the National Science Foundation, the Association of Science and Technology Centers, and other groups whose focus is informal science education. (FY 1995)
- Utilize resources to inform the general public about NASA's missions and their impact on science and technology through Space Grant, the Summer Faculty Fellowship Program, and JOVE. (FY 1995)

## Strengthening Partnerships for Change

Goal 3:
To significantly expand the impact of NASA's Education Program support of education reform by strengthening partnerships with key external constituencies.

The previous two goals outlining NASA's efforts in supporting education reform are targeted at realignment and refinement of the NASA education program. However, to greatly increase our impact on the national education system, we must strategically enhance our efforts with key national constituencies. NASA's role in forming partnerships with such groups varies. In some instances, NASA's role should be one of leadership. In others, it is one of a participant or a facilitator. The ultimate goal is to affect change and therefore have a greater impact on the educational community. The effectiveness of collaboration is a function of our collective creativity in leveraging existing educational efforts.

While the list of groups may change over time, currently four groups are identified:
1. Professional Education Associations;
2. National Aerospace Education Associations;
3. Industry; and
4. Other Federal Agencies.

### Professional Education Associations

NASA will continue to develop strong ties with discipline oriented professional education associations, including the National Science Teachers Association (NSTA), National Council of Teachers of Mathematics (NCTM), International Technology Education Association (ITEA), American Counseling Association (ACA), Quality Education for Minorities Network (QEM), National Alliance of Black School Educators (NABSE), American Society for Engineering Education (ASEE), Mathematical Association of America (MAA), the National Research Council (NRC), National Association of School Boards (NASB), National Association of Secondary School Principals (NASSP), National Association of Elementary School Principals (NAESP), National Action Council for Minorities in Engineering (NACME), American Association of University Women (AAUW), Society for Women Engineers (SWE), Association of Women in Science (AWS), the Association of Science and Technology Centers (ASTC), and such partnerships ensure that NASA's education program is relevant to and supportive of the education direction of each organization and its constituency.

*Objective:*
Establish close linkages with professional education associations to ensure that their efforts in support of national education reform are reflected in NASA education programs.

*Milestones:*
- Contribute financially to the development of science curriculum, teaching, and assessment standards (general consensus building element). (FY 1993)
- Provide financial support and technical expertise to NSTA for the purpose of fully integrating space and Earth science into Scope, Sequence, and Coordination (grades 6-12). (FY 1993)

- Establish a funded position(s) in organizations implementing national education standards and national curriculum frameworks (i.e., scope, sequence, and coordination). (FY 1994-1998)
- Target NASA support of national conventions on a rotating, three-year basis. (FY 1994)
- Establish a Volunteer Precollege Outreach Program in partnership with the American Institute for Aeronautics and Astronautics (AIAA) and convene a workshop composed of a task group of experts to outline an implementation manual for school presentation. (FY 1993)
- Continue discussion and cooperation on collaborative efforts with ASTC. (FY 1993)
- Initiate efforts with the MAA to explore linkages with mathematics reform in higher education. (FY 1994)

**National Aerospace Education Associations**

Those organizations whose primary purpose is to conduct national aerospace education programs represent a significant force in shaping national education reform. During 1993, NASA will explore mutual areas of interest and activity in support of this strategic plan with the Challenger Center for Space Science Education, U.S. Space Camp and Space Academy, U.S. Space Foundation, the Young Astronaut Council, and the Astronaut Memorial Foundation.

***Objective:***

Establish Memoranda of Understanding defining mutual areas of interest and activity in support of this strategic plan with interested aerospace education organizations.

***Milestones:***

- Host a meeting of the Executive Directors of the Challenger Center for Space Science Education, U.S. Space Camp and Space Academy, U.S. Space Foundation, the Young Astronaut Council, and the Astronaut Memorial Foundation. The primary purpose of this meeting will be to share NASA's Strategic Plan for Education and solicit advice and council from each organization represented on common activities and directions. (FY 1993)
- Finalize and sign a Memorandum of Understanding with any of the above interested aerospace education organizations supporting the national education reform efforts. (FY 1994)

**Industry**

In FY 1991, NASA joined with its top 26 industry contractors to form the NASA Industry Education Initiative (NIEI) in support of the National Education Goals. This effort has been the principal means to begin to coordinate and focus educational efforts with our industry partners. The initial effort with NIEI focused on preparing an inventory of the current educational offerings of each member and producing the NIEI Education Program Report, July 1991. The NIEI will continue to be the primary vehicle through which NASA will work with its industry partners on education support.

*Objective:*
Facilitate the collaboration of NASA's industry partners in the national education reform movement.

*Milestones:*
- Present the NASA Strategic Plan for Education to NIEI members. (FY 1993)
- Expand participation to other industry members in NIEI. (FY 1994)
- Identify potential areas of collaboration. (FY 1994)

## Other Federal Agencies

NASA's collaboration with other Federal agencies has been strengthened through the FCCSET/CEHR process. Numerous ongoing activities with the Department of Education, National Science Foundation, Department of Energy, National Oceanic and Atmospheric Administration, Federal Aviation Administration, Civil Air Patrol, and the Smithsonian have served to increase collaboration on programs and efforts of mutual interest.

*Objective:*
NASA will continue to develop collaborative relationships with other Federal departments and agencies in areas of common interests.

*Milestones:*
- Chair the Education Technology Working Group, FCCSET/CEHR. (FY 1993)
- Solicit participation of other Federal agencies in the Tri-State Education Initiative. (FY 1993)
- Solicit participation of other Federal agencies in the feasibility study of the National Scholars Program—a program concept to significantly expand the diversity of students receiving science, mathematics, engineering, and technology Ph.Ds. Special emphasis will be placed on involving African Americans, Hispanics, Native Americans, Pacific Islanders, women, and individuals with disabilities. Students from economically disadvantaged backgrounds will be targeted. (FY 1993-1994)
- Solicit appropriate educational video programs from other Federal agencies for airing on NASA Select. (FY 1993-1994)
- Define common areas of interest between Land Grant, Sea Grant, and Space Grant Programs with the Departments of Agriculture and Commerce. (FY 1995)
- Collaborate with the National Science Foundation and other agencies on the Statewide Systemic Change initiative and "EPSCoR" initiative. (FY 1993-1998)

## Enabling Systems

All of NASA's education programs—base programs, reform initiatives, and external partnerships—share common systems that ensure our ability to provide the most effective programs to our customers. These systems are embedded in all NASA education programs:

1. Evaluation;
2. The utilization of educational technology; and
3. The dissemination of education program information and curriculum materials.

## Program Evaluation

Evaluation is essential to the effectiveness of the NASA education program. Therefore, a comprehensive evaluation plan is being developed to ensure that necessary data are gathered to:

a. provide for accountability in the use of Federal funds;

b. monitor progress;

c. provide a feedback mechanism to guide program improvements; and

d. document program outcomes.

While it would be desirable to have the results of these evaluations prior to initiating change, the organizational, Federal, and national demands on NASA's education programs preclude delay. Consequently, NASA's evaluation plan for education includes both short- and long-term actions.

In the short-term, the following actions have been or will be conducted:

1. An organizational element within the Education Division—the Technology and Evaluation Branch—has been identified to serve as the unit responsible for planning, monitoring, or conducting evaluation activities.
2. An agencywide survey was completed in FY 1992 to identify all existing NASA education programs. This survey answered the questions: "What is the baseline for NASA's education program?" and "What is the mix of program targets (elementary, secondary, students, teachers, etc.)?" The Education Division will repeat this survey every three years.
3. During FY 1991 and 1992, individual education program managers strengthened the individual program evaluation process of each national program. Data from this effort will become available in FY 1993.
4. A data collection and management system has been designed and implementation is underway for all national education programs. Implementation will be completed by FY 1994.
5. The NASA Advisory Council Education Task Force was asked to review and provide guidance to NASA's strategic plan for education.
6. NASA is participating in FCCSET/CEHR activities designed to improve and coordinate evaluations of Federal education programs.

In the long-term, two major efforts are planned. First, the National Research Council will conduct a study to identify evaluation indicators for the range of NASA's education programs. These indicators will become standards against which individual programs will be evaluated for termination, modification, or enhancement. Second, the Agency's data management system will be expanded to all Field Centers to provide an agencywide database system of evaluation data. Additionally, the database will be modified as needed to be consistent with the recommendations resulting from the NRC study.

The following are specific objectives for the implementation of an evaluation component in NASA's education program.

***Objective:***
Develop, disseminate, and implement evaluation standards and guidance for education program managers.

***Milestones:***
- Develop internal review measures to begin review of all elementary and secondary programs. (Completed)
- Develop an interim document outlining program evaluation standards and procedures in coordination with the FCCSET/CEHR Evaluation Working Group and disseminate to NASA program managers for initial implementation. (FY 1993)
- Develop and disseminate a final document outlining program evaluation standards and procedures, after incorporation of recommendations from the NRC and from the FCCSET/CEHR Evaluation Panel of Experts. (FY 1994)
- Develop and implement an evaluation plan for individual NASA education program managers in conformance with the NASA education program evaluation standards. (FY 1995)

***Objective:***
Participate in the process led by the National Science Foundation under the auspices of the FCCSET/CEHR to implement a coordinated program evaluation strategy. As this process progresses and evaluation standards are developed, NASA's evaluation plan will be revised accordingly.

***Milestone:***
- The Chief of the Technology and Evaluation Branch, Education Division, will serve as the official NASA representative on the FCCSET/CEHR Evaluation Working Group. (FY 1993)

***Objective:***
Develop annual evaluation reports for each NASA education program or project. These reports will be designed to concisely summarize program progress, evaluation results, and recommendations for future action. An annual report summarizing major findings of individual program reports will be compiled.

***Milestones:***
- Submit an annual report for each education program to the Technology and Evaluation Branch. (FY 1994)
- Develop an agencywide report which summarizes the evaluation of the NASA education program. (FY 1994)

***Objective:***
Implement comprehensive databases of evaluation indicators for NASA's education program, currently under development, at Headquarters and expand to all NASA Field Centers.

***Milestones:***

- Complete Field testing and implement at Headquarters, a database of evaluation indicator data, known as EDCATS. (FY 1993)
- Revise and update the University Management Information System to provide increased analysis capability. (FY 1993)
- Implement the database of evaluation indicators at each NASA Field Center. (FY 1995)
- Refine and enhance the Space Grant database based on user feedback. (FY 1993-1994)

***Objective:***

Identify evaluation indicators for the NASA education program through a study by the NRC, under NASA contract. Implement the recommendations of this study in future evaluation plans as appropriate.

***Milestones***

- Initiate study by submitting to the NRC all data and information necessary to develop evaluation indicators. (FY 1993)
- Report by the NRC of its findings and recommended indicators. (FY 1994)
- Modify evaluation plans and databases to track data pertaining to indicators recommended by the NRC. (FY 1995)

***Objective:***

Develop a set of quality standards for all NASA education materials, in all formats, in collaboration with FCCSET/CEHR. These standards will serve as the basis for deletion, revision, or enhancement of NASA curriculum materials.

***Milestones:***

- Develop quality control standards addressing:
  a. technical accuracy;
  b. production quality;
  c. ethnic and gender diversity;
  d. pedagogical soundness; and
  e. alignment with relevant curriculum frameworks. (FY 1993)
- Evaluate all materials against the quality control standards and either remove them from the system, keep them in place, or develop appropriate supplementary materials. (FY 1995)

***Objective:***

Produce an annual report on NASA and universities for dissemination to program offices and Field Centers.

***Milestones:***

- Conduct a survey of customer needs. (FY 1993)

- Produce a prototype annual report and circulate it for comment and suggestion. (FY 1993)
- Publish the first annual report. (FY 1994)

## Educational Technology

The second enabling system identified as essential to all NASA education programs is the effective utilization of educational technology. NASA is an agency dedicated to the development of advanced technologies, and it is appropriate that technology play a major role in the operation of its education program. The intent of the Education Division is to utilize educational technologies to the fullest potential in order to maximize limited resources and expand the delivery of programs to the broadest possible audience.

***Objective:***

Expand NASA Select, the Agency's internal communication service, to better serve the education community by including regular segments of programming for faculty, teachers, and students.

Make NASA Select available to other FCCSET/CEHR agencies, Space Grant universities, and other education entities with which NASA has established education partnerships. Intensify efforts to disseminate information about the education programming on NASA Select through Spacelink, public affairs channels, partner organizations, and other means.

***Milestones:***

- Implement a daily segment of educational programming. (FY 1993)
- Inform educational organizations, networks, and teachers of NASA Select program opportunities. (FY 1994)
- Utilize Select to the fullest extent to provide regular programs for all constituent groups. (FY 1995)

***Objective:***

Enhance NASA Spacelink[12] to include

a. a full-time system administrator;

b. expanded toll-free access through public domain computer networks; and

c. improved interactive capabilities.

***Milestones:***

- Implement file transfer capability via the Internet on Spacelink. (FY 1993)
- Implement toll-free telephone access to Spacelink. (FY 1993)
- Implement a plan to ensure that all current educational publications are available on Spacelink. (FY 1994)

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[12] *Spacelink is NASA's computer information service containing aerospace information and educational materials for faculty, teachers, and students. The service includes current NASA news, data about America's aerospace program, classroom materials, and other information useful to faculty, teachers, and students.*

***Objective:***
Establish a Classroom of the Future (COTF) to serve as a research and development facility for educational programs based on advanced communications technologies. The COTF will include facilities where technologies for aerospace education can be implemented and evaluated with visiting faculty, teachers, and students. The COTF will also serve as a distance education facility from which preservice and inservice education programs can be disseminated to schools and teachers nationwide.

***Milestones:***
- Fully staff the COTF to ensure that personnel resources are available to support the Agency's research and development activities in educational technology. (FY 1993).
- Complete the construction of a facility for the COTF. (FY 1994)
- Develop, field test, evaluate, and disseminate NASA educational technology software. (FY 1997)

***Objective:***
Expand the Teacher Resource Center Network (TRCN) and integrate it into the educational technology component of NASA's education program by installing appropriate equipment and software for the demonstration or duplication of computer software, videodiscs, and CD-ROM disks. A plan will be developed and implemented to transfer existing and new slides, videos, publications, and similar educational materials to optical media such as CD-ROM or videodisc for cost-effective storage and distribution.

***Milestones:***
- Implement quality-control standards for all TRCN materials and implement procedures to ensure distribution of all NASA educational materials to the TRCN. (FY 1993)
- Upgrade TRCN educational technology equipment. (FY 1994)
- Expand the TRCN to include all 50 states, the District of Columbia, and Puerto Rico. (FY 1994)

***Objective:***
Utilize distance learning technologies to broaden the dissemination of NASA educational opportunities.

***Milestone:***
- Study the feasibility of utilizing NASA Select and Spacelink to deliver a distance education course in Earth systems science for science teachers. Implement the course if feasible. (FY 1994-1995)

***Objective:***
Chair the FCCSET/CEHR Educational Technology Working Group and contribute to the accomplishment of FCCSET/CEHR objectives pertaining to educational technology.

***Milestones:***
- Develop an inventory of all NASA educational technology programs and lead the development of a FCCSET/CEHR inventory. (FY 1993)
- Contribute to the Federal goal of ensuring that students participate in research with the scientific community. (FY 1994)
- Lead the FCCSET/CEHR Educational Technology Working Group in the development and communication of a national vision for networked resources. (FY 1994)

***Objective:***
Maintain and support FEDIX, an on-line information service that links the higher education community and the Federal government, facilitating research, education, and services.

***Milestone:***
- Review the concept of on-line submission of grant proposals and determine its potential for NASA. (FY 1994)

## Dissemination

NASA has taken significant actions since the late 1980s to coordinate and disseminate educational information and materials among its facilities and within the education community. Fundamental to this plan is the realization that, even with significant increases in personnel, NASA's ability to work directly with teachers through its Field Centers or in their schools is limited. Therefore, in addition to direct interaction between educators and personnel at the Field Centers, NASA must make available information, materials, and services to the national education community.

NASA's national dissemination plan for information and materials is comprised of three elements:

1. The electronic dissemination of text and graphics through NASA Spacelink and the electronic dissemination of announcements of opportunity, requests for proposals, and specific scientific and technical information and opportunities through FEDIX;
2. The dissemination of educational videotapes and television programming through NASA Select; and
3. On-site or mail-in acquisition of educational materials—printed, computer, video, and slides—through the NASA Teacher Resource Center Network and Central Operation of Resources for Educators [15]

[15] *A list of TRCN members is in Appendix I.*

Objectives relevant to each element of this national dissemination plan are included in previous sections of this strategic plan. For example, in the Educational Technology section of "Enabling Systems," specific objectives to expand and enhance Spacelink, NASA Select, and the Teacher Resource Center Network are discussed in detail.[14] In addition, the "NASA Education Program and Information Dissemination Plan," prepared in response to U.S. Senate Report 102-107, September 1992, is incorporated by reference and reaffirms the objectives and milestones stated therein.[15]

[14] *See pages 38, 41.*
[15] *This report is duplicated in Appendix I.*

# Management Priorities to Guide Change

The outstanding challenge of the Strategy for Change is its implementation. In order to implement the strategy, four broad-based management priorities have been identified to guide the process of change:

1. To use "A Strategy for Change: 1993-1998" as a programmatic and management tool for developing a consensus direction for NASA's education program.
2. To implement an agency program planning and budgetary process for the NASA Education Program and to transition from a support (functional management) approach to a program (operational) approach for planning, management, and budget.
3. To identify, articulate, and employ an integrated agency strategy to significantly increase ethnic and gender diversity in the science and technology pipeline.
4. To provide comprehensive staff development opportunities to ensure our employees and contractors have the proper knowledge and competencies to implement this strategic plan and reach NASA's Education Vision.

These priorities will be pursued in parallel and in accordance with the objectives and milestones listed below.

**Priority:**
To use "A Strategy for Change: 1993-1998" as a programmatic and management tool for developing a consensus direction for NASA's education program.

***Objectives:***
Distribute the first edition of the Strategic Plan to Program offices, Field Centers, NASA education contractors, and NASA's partners in education. Additional input and suggestions for improvement will be sought continually by all stakeholders and reflected in subsequent editions of the Strategic Plan. (First quarter FY 1993)

Publish the document "NASA's Education Program Inventory" and distribute to NASA Field Centers and Program offices. This agencywide inventory will become the baseline for analysis and review of current efforts. (FY 1993)

Initiate a planning process with each Field Center that results in a Center education plan supporting the Agency Strategic Plan. (FY 1993)

Finalize Center plans. (FY 1994)

Conduct an agencywide survey of NASA education programs. (FY 1995)

Update NASA's Strategic Plan for Education each year to reflect stakeholder input. (FY 1993-1998)

**Priority:**
To implement an agency program planning and budgetary process for the NASA Education Program and to transition from a support (functional management) approach to a program (operational) approach for planning, management, and budget.

***Objectives:***
Develop a transition plan to evolve NASA's Education Program into the NASA Program Operating Plan (POP) Cycle, in cooperation with the Office of the Comptroller, appropriate Program offices, and the Field Centers. (FY 1993)

During the transition period, take intermediate steps to seek Center input to develop NASA's FY 1995 budget and program for education, based on NASA's Education Strategic Plan. (FY 1993)

Based on the transition plan, incorporate NASA's Education Program into the Program Operating Plan Cycle. (FY 1994-1998)

**Priority:**
To identify, articulate, and employ an integrated agency strategy to significantly increase ethnic and gender diversity in the science and technology pipeline.

***Objectives:***
In cooperation with agency personnel, training and development, and equal opportunity offices, identify, articulate, and employ an integrated strategy to significantly increase participation by African Americans, Hispanics, Native Americans, Pacific Islanders, women, and persons with disabilities who have traditionally been underrepresented in the science and technology pipeline. (FY 1993)

Complete the Congressionally mandated feasibility study of the National Scholars Program (NSP) and report to Congress the final results. Plan and implement those elements of NSP for which NASA has current authority. (FY 1994)

In cooperation with the Minority University Research and Education Division, identify a unified approach on university related issues, programs, and activities. (FY 1994)

**Priority:**
To provide comprehensive staff development opportunities to ensure our employees and contractors have the proper knowledge and competencies to implement this strategic plan and reach NASA's Education Vision.

*Objectives:*

The Headquarters Education Division will pursue a long-term organizational development process to infuse elements of Total Quality Management (TQM)/Continuous Improvement into its management and programmatic structure. (FY 1993-1998)

Headquarters education program managers will ensure that staff development is an integral part of educational outreach contracts. Special emphasis will be placed on a content understanding of education reform. (FY 1993-1998)

Each Center will ensure that staff development is an integral part of developing their education plan. (FY 1993-1998)

# Conclusion

NASA's Education Vision is ambitious—but the next generation of science, engineering, technology, and research will only be as good as the next generation of scientists, engineers, technicians, and teachers. To ensure the availability of a well-educated future workforce, NASA has committed the Agency's unique resources to promote excellence and diversity in the education system through enhancing and expanding scientific and technological excellence and equity.

As stated in this "Strategy for Change," we will build upon the strength of our existing base program to contribute to educational excellence in a broader context. NASA has begun a number of initiatives that directly support the National Education Goals, the FCCSET/CEHR implementation priorities, and the emerging national education standards. We will leverage our efforts through partnerships with professional education associations, aerospace education organizations, industry, and other Federal agencies. Our enabling systems will help us ensure that high quality educational programs and materials are available to educators nationwide. For each of these areas, we have identified specific objectives and milestones against which we will measure our progress over the next five years. We have also identified four management priorities to focus our internal efforts in the near future. These management priorities are the first steps along the road to excellence.

The scope of NASA's role in education is small when compared financially to that of the Department of Education or the National Science Foundation. However, by leveraging the Agency's unique resource—its facilities and personnel—NASA has the opportunity to use its inspiring mission as an effective vehicle for teaching and for learning. As a Federal Agency with a vested interest in the Nation's scientific and technological health, education is not only an opportunity for NASA, it is an obligation.

# Acronyms

| | |
|---|---|
| AAUW | American Association of University Women |
| AIAA | American Institute for Aeronautics and Astronautics |
| ACA | American Counseling Association |
| AESP | Aerospace Education Services Program |
| ASEE | American Society for Engineering Education |
| ASTC | Association of Science and Technology Centers |
| AWS | Association of Women in Science |
| CD-ROM | Compact Disc, Read Only Memory |
| CEHR | Committee on Education and Human Resources (of FCCSET) |
| CORE | NASA-Central Operation of Resources for Educators |
| COTF | Classroom of the Future |
| DSO | Detailed Supplemental Objective |
| EPSCoR | Experimental Programs for the Stimulation of Competitive Research |
| EWG | Education Working Group (NASA Johnson Space Center) |
| FCCSET | Federal Coordinating Council for Science, Engineering and Technology |
| FCOD | Flight Crew Operations Directorate (NASA Johnson Space Center) |
| HBCUs | Historically Black Colleges and Universities |
| ITEA | International Technology Education Association |
| JOVE | NASA/University JOint VEnture |
| GAS | Get Away Special |
| MAA | Mathematical Association of America |
| MU-SPIN | Minority University-Space Interdisciplinary Network |
| NABSE | National Alliance of Black School Educators |
| NACME | National Action Council for Minorities in Engineering |
| NAESP | National Association of Elementary School Principals |
| NASA | National Aeronautics and Space Administration |
| NASB | National Association of School Boards |
| NASSP | National Association of Secondary School Principals |
| NCTM | National Council of Teachers of Mathematics |
| NEWEST | NASA Educational Workshops for Elementary School Teachers |
| NEWMAST | NASA Educational Workshops for Mathematics, Science, and Technology Teachers |
| NIEI | NASA Industry Education Initiative |
| NOAA | National Oceanic and Atmospheric Association |
| NRC | National Research Council |
| NSF | National Science Foundation |
| NSP | National Scholars Program |

| | |
|---|---|
| NSTA | National Science Teachers Association |
| OAST | Office of Aeronautics and Space Technology (NASA) |
| QEM | Quality Education for Minorities Network |
| RTRC | NASA Regional Teacher Resource Center |
| SAREX | Shuttle Amateur Radio Experiment |
| SEEDS | Space Exposed Experiment Developed for Students |
| SHARP | Summer High School Apprenticeship Research Program |
| SMET | Science, Mathematics, Engineering, and Technology (education) |
| SSI | Statewide Systemic Initiatives Program (NSF) |
| SSIP | Space Science Student Involvement Program |
| STEP | Space Technology Education Program |
| SWE | Society for Women Engineers |
| TQM | Total Quality Management |
| TRC | NASA Teacher Resource Center |
| TRCN | NASA Teacher Resource Center Network |
| TSEI | Tri-State Education Initiative |
| USRA | Universities Space Research Association |

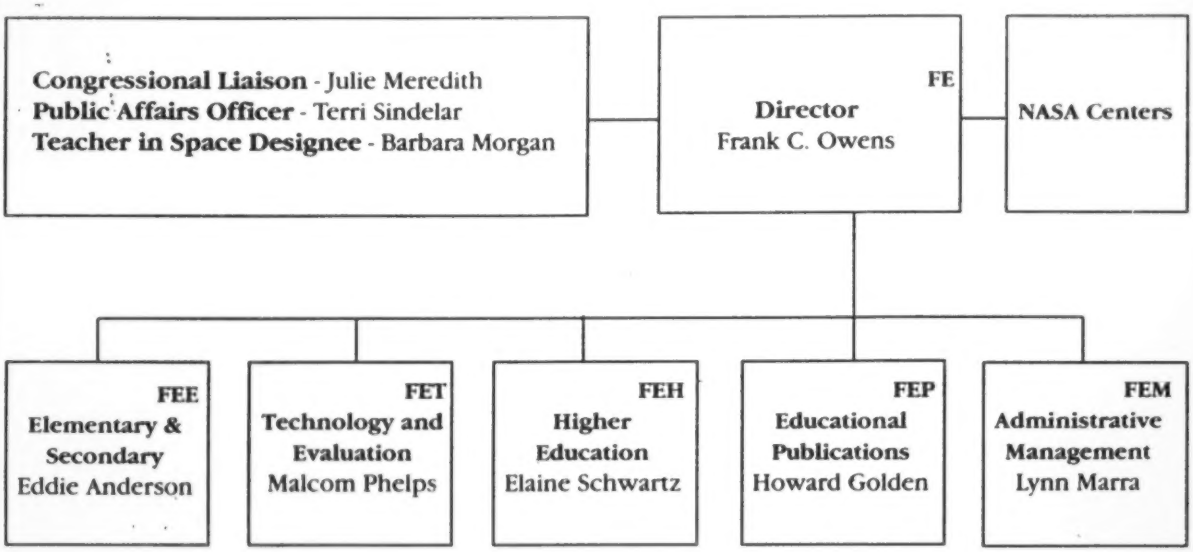
# Appendix A

The authority for NASA's education policy is derived from the National Aeronautics and Space Act of 1958, as amended. Specific sections of the Act applicable to this policy follow:

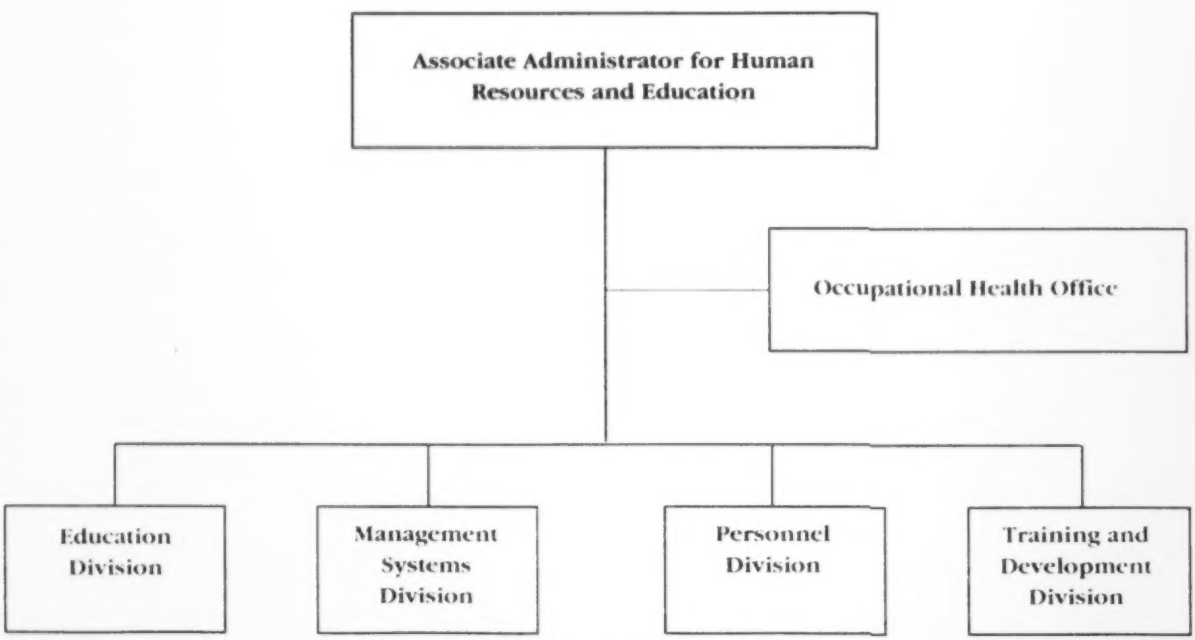
1. Section 42 USC 2473(2): Arrange for participation by the scientific community in planning scientific measurements and observations to be made . . . (Note: Realizing the current crises in education, our changing demographics, and the extensive documentation on the relationship between pre-college student achievement and entrance into science, engineering, and technology professions, NASA expands the traditional definition of scientific community to include elementary, secondary, and community college levels.)
2. Section 102C(1): The expansion of human knowledge of phenomena in the atmosphere and space (Note: Education is the vehicle by which human knowledge is acquired and transmitted.)
3. Section 102C(5): The preservation of the role of the United States as a leader in aeronautical and space science and technology . . . . (Note: This objective is totally dependent on an available talented, knowledgeable, and skilled workforce.)
4. Section 102C(8): The most effective utilization of the scientific and engineering resources of the United States, . . . .

# Appendix B

**Education Division Organization Chart**
**Office of Human Resources & Education Program Responsibilities**




**Office of Human Resources and Education**



# Appendix C

## The President and the Governors' National Education Goals

By the Year 2000:

1. The children in America will start school ready to learn.
2. U.S. high school graduation rate will increase to 90 percent.
3. American students will leave grades four, eight, and twelve having demonstrated competency in challenging subject matter including English, mathematics, science, history, and geography; and every school in America will ensure that all students learn to use their minds well, so they may be prepared for responsible citizenship, further learning, and productive employment in our modern economy.
4. U.S. students will be first in science and mathematics achievement.
5. Every adult American will be literate and will possess the knowledge and skills necessary to compete in a global economy and exercise the rights and responsibilities of citizenship.
6. Every school in America will be free of drugs and violence and will offer a disciplined environment conducive to learning.

# Appendix D

## Office of Science and Technology Policy Federal Coordinating Council for Science, Engineering and Technology Committee on Education and Human Resources (FCCSET/CEHR)

**Chair**
Secretary of Energy

**Vice Chairs**
Deputy Secretary, Department of Education
Assistant Director for Education and Human Resources, National Science Foundation

**Members:**
Department of Agriculture
Department of Commerce
Department of Defense
Department of Education
Department of Energy
Department of Health and Human Services
Department of Housing and Urban Development
Department of the Interior
Department of Justice
Department of Labor
Department of Transportation
Department of Veterans Affairs
Environmental Protection Agency
National Aeronautics and Space Administration
National Science Foundation
Smithsonian Institution
Office of Science and Technology Policy
Office of Policy Development
Office of Management and Budget

## Federal Science, Engineering, and Mathematics Education Strategic Planning Framework

**Strategic Objectives**

- Improve science and mathematics performance
- Strong elementary and secondary teacher workforce
- Adequate pipeline for science and technology workforce, including greater participation of individuals underrepresented in science, mathematics, engineering and technology education, e.g. women, minorities and persons with disabilities
- Improved public science literacy

**Implementation Priorities**

**Elementary and Secondary Education**

- Standards for curriculum, teaching, and assessment
- Materials (curriculum, course, and instructional)
- Teacher enhancement
- Systemic reform

**Undergraduate Education**

- Materials (curriculum, course, and instructional)
- Faculty development and enhancement

**Graduate Education**

- Student support, incentives, and opportunities
- Recruitment and retention of U.S. students
- Foster multidisciplinary/applied research/technology programs

**Public Understanding of Science**

- Standards for public science literacy
- Increase public science literacy

**Technology Education**

- Curriculum reform
- Teacher enhancement

**Implementation Components**

- Evaluation and assessment
- Dissemination and technical assistance
- Education technologies

# Appendix E

## NASA Teacher Resource Center Network

The NASA Education Division disseminates educational products and materials for teachers and students of all grade levels through the NASA Field Centers, the Teacher Resource Center Network (TRCN), NASA Select, and NASA Spacelink. The TRCN is composed of Teacher Resource Centers (TRCs), Regional TRCs (RTRCs), and the NASA Central Operation of Resources for Educators (CORE). The TRCs and RTRCs are the principal distribution points where educators may copy NASA text, audio, visual, and computer materials. CORE processes U.S. and international educator requests for audio-visual materials by mail. The TRCN serves over 110,000 teachers every year.

### Teacher Resource Centers (TRCs)

TRCs are located at twelve NASA installations, and they have a variety of NASA-related educational materials in several formats: videotapes, slides, audio tapes, publications, lesson plans, and activities.

### Regional Teacher Resource Centers (RTRCs)

To offer more educators the opportunity to visit the TRCN, NASA forms partnerships with planetariums, universities, museums, and other nonprofit organizations to serve as RTRCs and plans to have RTRCs as broadly distributed geographically as possible. Teachers may preview or copy NASA materials at these RTRCs.

### Central Operation of Resources for Educators (CORE)

CORE provides educators with another source for NASA educational audio-visual materials. CORE is a nonprofit institution which mails audio and visual materials at cost, plus shipping and handling, to U.S. and to international educators. An educator may request a catalogue and an order form from CORE by writing on school letterhead or by telephoning:

NASA CORE
Lorain County Joint Vocational School
15181 Route 58 South
Oberlin, OH 44074
(216) 774-1051, ext. 293 or 294

## NASA Teacher Resource Centers

**Alaska, Arizona, California, Hawaii, Idaho Montana, Nevada, Oregon, Utah, Washington, Wyoming**
NASA Ames Research Center
Teacher Resource Center
Mail Stop TO-25
Moffett Field, CA 94035

**California (Mainly cities near Dryden Flight Research Facility)**
NASA Dryden Flight Research Facility
Public Affairs Office (Trl. 42)
Teacher Resource Center
Edwards AFB, CA 93523

**Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont**
NASA Goddard Space Flight Center
Teacher Resource Laboratory
Mail Code 130.3
Greenbelt, MD 20771

**Virginia's and Maryland's Eastern Shores**
Wallops Flight Facility
Education Complex—
Visitor Center
NASA Teacher Resource Center
Bldg. J-17
Wallops Island, VA 23337

**All Planetary Exploration Inquiries**
Jet Propulsion Laboratory
Teacher Resource Center
JPL Educational Outreach
4800 Oak Grove Drive
Mail Code CS-530
Pasadena, CA 91109

**Florida, Georgia, Puerto Rico, Virgin Islands**
NASA Kennedy Space Center
Educators Resource Laboratory
Mail Code ERL
Kennedy Space Center, FL
32899

**Colorado, Kansas, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas**
NASA Johnson Space Center
Teacher Resource Center
Mail Code AP-4
Houston, TX 77058

**Kentucky, North Carolina, South Carolina, Virginia, West Virginia**
NASA Langley Research Center
Teacher Resource Center
Mail Stop 146
Hampton, VA 23665-5225

NASA Teacher Resource Center
Virginia Air and Space Center
600 Settler's Landing Road
Hampton, VA 23669

**Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin,**
NASA Lewis Research Center
Teacher Resource Center
Mail Stop 8-1
21000 Brookpark Road
Cleveland, OH 44135

**Mississippi**
NASA Stennis Space Center
Teacher Resource Center
Building 1200
Stennis Space Center, MS 39529

**Alabama, Arkansas, Iowa, Louisiana, Missouri, Tennessee**
U. S. Space & Rocket Center
NASA Teacher Resource Center
Huntsville, AL 35807

## Regional Teacher Resource Centers

**Alabama**
Tri-State Learning Center
Teacher Resource Center
Rt. 72 West, Box 508
Iuka, MS 38854

**Arizona**
Lunar and Planetary Lab
NASA Regional Teacher Resource Center
University of Arizona
Tucson, AZ 85721

**Arkansas**
University of Arkansas-Little Rock
Natural Science Bldg., Room 215
2801 South University
Little Rock, AK 72204

**Colorado**
U.S. Space Foundation
NASA Regional Teacher Resource Center
2860 S. Circle Drive
Suite 2301
Colorado Springs, CO 80906

**Delaware**
Delaware Teacher Center
Claymont Education Campus
NASA Regional Teacher Resource Center
3401 Green Street
Claymont, Delaware 19703

**District of Columbia**
National Air and Space Museum
Smithsonian Institution
Education Resource Center,
MRC-305
Washington, DC 20560

University of the District of Columbia
NASA Regional Teacher Resource Center
Mail Stop 4201
4200 Connecticut Ave. N.W.
Washington, DC 20008

**Idaho**
University of Idaho at Moscow
NASA Regional Teacher Resource Center
College of Education
Moscow, ID 83843

**Iowa**
University of Northern Iowa
NASA Regional Teacher Resource Center
IRTS
Room 222, Schindler Education Center
Cedar Falls, IA 50614-0009

**Illinois**
Chicago Museum of Science and Industry
NASA Regional Teacher Resource Center
57th Street & Lakeshore Drive
Chicago, IL 60637-2093

Parks College of St. Louis University
NASA Regional Teacher Resource Center
Rt. 157 and Falling Springs Road
Cahokia, IL 62206

**Indiana**
University of Evansville
NASA Regional Teacher Resource Center
School of Education
1800 Lincoln Avenue
Evansville, IN 47722

**Kansas**
Kansas Cosmosphere and Space Center
NASA Regional Teacher Resource Center
1100 North Plum
Hutchinson, KS 67501

**Kentucky**
Murray State University
NASA Regional Teacher Resource Center
Waterfield Library
Murray, KY 42071

**Louisiana**
Bossier Parish Community College
NASA Regional Teacher Resource Center
2719 Airline Drive
Bossier City, LA 71111

## Regional Teacher Resource Centers

**Louisiana**
Southern University
NASA Regional Teacher Resource Center
Downtown Metro Center
610 Texas Street
Shreveport, LA 71101

**Michigan**
Central Michigan University
NASA Regional Teacher Resource Center
Ronan Hall, Room 101
Mount Pleasant, MI 48859

Northern Michigan University
NASA Regional Teacher Resource Center
Olson Library Media Center
Marquette, MI 49855

Oakland University
NASA Regional Teacher Resource Center
O'Dowd Hall, Room 216
Rochester, MI 48309-4401

**Minnesota**
Mankato State University
NASA Regional Teacher Resource Center
Department of Curriculum and Instruction
MSU Box 52/P.O. Box 8400
Mankato, MN 56002-8400

St. Cloud State University
Center for Information Media
NASA Regional Teacher Resource Center
St. Cloud, MN 56301

**Mississippi**
Mississippi Delta Community College
NASA Regional Teacher Resource Center
P.O. Box 1??
Moorehead, MS 38761

Tri-State Learning Center
Teacher Resource Center
Rt. 72 West, Box 508
Iuka, MS 38854

**Montana**
Western Montana College of the
University of Montana
NASA Regional Teacher Resource Center
Carson Library
Dillon, MT 59725

**Nebraska**
University of Nebraska State Museum
NASA Regional Teacher Resource Center
14th & U Streets
307 Morrill Hall
Lincoln, NE 6858840338

**New Mexico**
New Mexico State University
NASA Regional Teacher Resource Center
New Mexico Space Grant Consortium
Box 30001, Dept. SG
Las Cruces, NM 8800340001

University of New Mexico
NASA Regional Teacher Resource Center
Continuing Education and
Community Service
1634 University N.E.
Albuquerque, NM 87131

**New York**
The City College
NASA Regional Teacher Resourte Center
NAC Bldg., Rm. 5224
Convent Avenue at 138th St.
New York, NY 10031

**North Carolina**
University of North Carolina —Charlotte
NASA Regional Teacher Resource Center
J. Murrey Atkins Library
Charlotte, NC 28223

**North Dakota**
University of North Dakota
NASA Regional Teacher Resource Center
The Wayne Peterson Room
Earth Systems Science Building
P.O. Box 7306, University Station
Grand Forks, ND 58202-7306

**Ohio**
University of Cincinnati
NASA Regional TeacherResource Center
Curriculum Resources Center
1613 Blegen Library
University of Cincinnati
Cincinnati, OH 45221-0219



BEST COPY AVAILABLE

## Regional Teacher Resource Centers

**Oklahoma**
Oklahoma State University
NASA Regional Teacher Resource Center
300 North Cordell
Stillwater, OK 740780422

**Pennsylvania**
Mid Atlantic Technology Application Center
NASA Regional Teacher Resource Center
University of Pittsburgh
823 William Pitt Union
Pittsburgh, PA 15260

**Rhode Island**
Rhode Island College
NASA Regional Teacher Resource Center
Curriculum Resources Center
600 Mt. Pleasant Avenue
Providence, RI 02908

**South Carolina**
Stanback Planetarium
NASA Regional Teacher Resource Center
P.O. Box 1636
South Carolina State University
Orangeburg, SC 29117

**Tennessee**
Tri-State Learning Center
Teacher Resource Center
Rt. 72 West, Box 508
Iuka, MS 38854

**Utah**
Weber State University
NASA Regional Teacher Resource Center
Curriculum Library
College of Education
Ogden, UT 84408-1302

**Vermont**
Norwich University
Vermont College Educational
Resource Center
NASA Regional Teacher Resource Center
Schulmaier Hall
Montpelier, VT 05602

**Virginia**
Radford University
NASA Regional Teacher Resource Center
Radford, VA 24142

**Washington**
University of Washington
NASA Regional Teacher Resource Center
AK-50, c/o Geophysics Department
Seattle, WA 98195

**West Virginia**
Wheeling Jesuit College
NASA Regional Teacher Resource Center
220 Washington Avenue
Wheeling, WV 26003

**Wisconsin**
University of Wisconsin at LaCrosse
NASA Regional Teacher Resource Center
Morris Hall, Room 200
LaCrosse, WI 54601

**Wyoming**
University of Wyoming
NASA Regional Teacher Resource Center
Learning Resource Center
P.O. Box 3374, University Station
Laramie, WY 82071-3374

# Appendix F

The "NASA Education Program and Information Dissemination Plan," prepared in response to U.S. Senate Report 102-107, September 1992, follows:

NASA

National Aeronautics and
Space Administration

Washington, D C
20546

Office of the Administrator

October 13, 1992

The Honorable Barbara A. Mikulski
Chair
Subcommittee on VA-HUD-
Independent Agencies
Committee on Appropriations
United States Senate
Washington, DC 20510

Dear Madam Chair:

In response to direction included in the Senate Reports accompanying both the FY 1992 and FY 1993 VA-HUD-Independent Agencies appropriations bills, I am pleased to provide the Committee NASA's plan for disseminating educational information among NASA facilities and throughout the external community. This plan has been revised from the version transmitted to the Committee earlier this year to include specific goals and objectives, along with milestones for accomplishing those goals.

NASA has taken significant action over the past year to coordinate and disseminate educational information. Most notably, we have developed a draft Strategic Plan for Education. The Strategic Plan, expected to be finalized in November, will outline the standards by which NASA will measure its education programs and will include an expanded plan for the dissemination of program information, products, and services.

As a Federal agency with a vested interest in the nation's scientific and technological health, NASA views education not only as an opportunity, but also as an obligation. By leveraging NASA's unique resources--its facilities and personnel--we are using NASA's unique mission as a vehicle for teaching and learning. I would be pleased to discuss this report with you in greater detail, if you wish.

Sincerely,

Daniel S. Goldin
Administrator

Enclosure

cc:
The Honorable Edwin (Jake) Garn

TABLE OF CONTENTS

NASA EDUCATION PROGRAM AND INFORMATION DISSEMINATION PLAN

September 1992


| | | Page |
|---|---|---|
| I. | Introduction | 1 |
| II. | Internal Coordination and Information Dissemination | 2 |
| III. | External Coordination and Information Dissemination | 4 |
| | Physical Presence in Each State | 4 |
| | Electronic Delivery Systems | 6 |
| | High-Leverage Activities | 8 |
| IV. | Conclusion | 10 |
| Appendix A: | NASA Education Program Coordinators | |

# NASA EDUCATION PROGRAM AND INFORMATION DISSEMINATION PLAN

September 1992

## I. INTRODUCTION

> *The Committee also directs NASA to prepare a plan for disseminating educational information among its facilities and with the outside community and to identify a point of contact at each facility to coordinate the educational activities.*
> (U.S. Senate Report 102-107)

This report has been prepared to address specific concerns of the Committee regarding NASA's education program coordination and dissemination efforts. It has been developed in active participation with the Federal Coordinating Council for Science, Engineering, and Technology (FCCSET), Committee on Education and Human Resources (CEHR) and is fully consistent with the recently developed FCCSET/CEHR strategic plan. In addition, objectives and milestones reflected in this dissemination plan are consistent with NASA's Strategic Plan for Education, currently under review and scheduled for completion by November 1992.

NASA's education program is comprehensive, meeting the needs of teachers and students in grade school through graduate school. It is NASA's policy to utilize its inspiring mission, its unique facilities, and its specialized workforce to conduct, and to leverage externally conducted, science, mathematics, and technology education programs and activities. NASA supports systemic change in the education system by expanding and enhancing the scientific and technological competence of all educators involved in the education reform movement. During FY 1991, the Agency's programs reached over 1.5 million students and 130,000 teachers and university faculty.

The NASA Field Centers provide a rich and stimulating environment for education, and NASA supports a large number of programs that provide personal interaction between our specialized workforce, students, and educators. In these programs, precollege students and teachers participate in hands-on, real world applications of mathematics, science, and technology, while college and university students and faculty directly participate in the NASA mission through research opportunities. The dissemination of information is implicit in all of these participatory programs.

However, we realize that not every student and educator can participate in on-Center programs. To fulfill NASA's commitment to the education community and to ensure that our extensive education efforts reach the broadest possible audience, we extend our programs and services to the Nation through a variety of dissemination strategies: a physical presence in every state; electronic delivery systems; and high-leverage activities through partnerships with other educational, industrial, and non-profit associations. Strong internal leadership, coordination, and information dissemination ensure that all of NASA's educational programs meet or exceed the standards articulated in the Agency Strategic Plan for Education and that these programs effectively and efficiently serve the needs of the Nation's educators.

Two implementation priorities are embedded in all the activities described herein. First, special emphasis is placed throughout on outreach to the educationally disadvantaged and groups historically underrepresented in science, mathematics, and technology. Second, all programs will include both summative and formative evaluation components, incorporating national education reform benchmarks. A product (curriculum supplement) evaluation system will be established to ensure that new materials meet the standards of the Agency's education program. These implementation priorities are defined and discussed further in NASA's forthcoming Strategic Plan for Education.

## I. INTERNAL COORDINATION AND INFORMATION DISSEMINATION

Leadership and coordination of NASA's education program is the responsibility of the Associate Administrator, Office of Human Resources and Education, reporting to the NASA Administrator. Within this office, the Education Division has Agency responsibility for policy development, management oversight, coordination, and direction of NASA's education program. The overall conduct of NASA's education program is formally outlined in NASA Management Instruction 1392.1B, Conduct of NASA's External Education Program, issued December 31, 1991.

To ensure close coordination, communication, and sound management of education programs agencywide, each NASA Program Associate Administrator and each NASA Field Center Director has designated a single individual to serve as the focal point for that Office's or Field Center's education program (See Appendix A). The Associate Administrator for Human Resources and Education and the Director of Education periodically convene agencywide meetings of all designated education coordinators. These meetings provide executive leadership and policy direction to the NASA Centers for overall program composition and direction. NASA elementary/secondary education and university affairs staff also hold periodic meetings on programmatic, coordination, and other anticipated education issues facing the Agency. Additional meetings are held with Headquarters and Field Center education personnel to discuss specific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program issues, product development, and planning. These meetings are followed by monthly agencywide teleconferences to update the educational staff on recent developments, emerging issues, and related topics.

Central to coordinating NASA's education efforts within the Federal government is the Agency's active participation in FCCSET/CEHR. This participation has not only contributed to a government-wide consensus on strategic objectives for education and program implementation priorities, it has provided numerous opportunities for interagency collaboration and program information sharing. Some examples of collaborative projects underway with other departments/agencies include: the National Science Foundation (Space Grant/EPSCoR, Pre-service Education), Department of Education (AMERICA 2000, International Assessment Studies, Christa McAuliffe Fellowships), Department of Agriculture (Space Grant/Land Grant), Department of Energy ("On Line" Information Dissemination, Chicago Teachers Academy, Tri-State Education Initiative, PBS, teacher workshops).

While the aforementioned activities provide mechanisms to internally coordinate NASA's education program, a broader, long-range planning effort is currently under development. The Strategic Plan for Education is being developed in consultation with NASA Headquarters Program Offices and NASA Field Centers in support of the national education reform agenda. Once completed, the plan will provide agencywide direction for NASA's education program, supporting and aligned with the FCCSET/CEHR strategic plan. During FY 1993, the Director of the Education Division will work with each NASA Field Center to develop Center specific education plans in support of the Agency's Strategic Plan for Education. This significant planning effort will not only provide a focused direction for NASA's education program, but will also provide a management tool for coordination and evaluation.

Thus, to effectively serve the needs of the national education community, NASA will ensure that the Agency's education program is coordinated through a strong internal management structure with a clear direction for the future, as outlined in the following objectives.

Objective: Enhance internal communication and coordination of NASA's education program.

Milestones: FY 1992 - Designate an Associate Administrator for Human Resources and Education. (Completed: October 1991)

FY 1992 - Each NASA Program Associate Administrator and each Field Center Director will designate an individual to serve as the focal point for the programs implemented by Field Centers. (Completed: April 1992)

Objective: Develop an agencywide plan for long-range coordination of NASA's education program.

Milestones: FY 1993 - Complete the NASA Strategic Plan for Education. Initiate individual Center education planning efforts.

FY 1994 - Complete Center education plans in support of Agency Strategic Plan for Education.

## II. EXTERNAL COORDINATION AND INFORMATION DISSEMINATION

In the late 1980's, NASA initiated a plan for educational program and information dissemination nationwide. Fundamental to this plan was the realization that, even with significant increases in personnel, NASA's ability to work directly with teachers through its Field Centers or in their schools is limited. The Agency's planning has since evolved into a three-part approach:

1. A physical presence in each state;
2. Electronic delivery systems; and
3. High-leverage activities through partnerships with other educational, industrial, and non-profit associations.

### Physical Presence in Each State

NASA realizes that not every educator and student can visit a Field Center. Therefore, in order to facilitate the Agency's impact on the national education system, NASA is developing a physical presence in each state. This national network will provide distribution points for the dissemination of NASA educational materials and program information.

In the mid-1980's, NASA established the NASA Teacher Resource Center Network (TRCN), which provides an information dissemination point in each state for the distribution of NASA information and education materials (e.g., videotapes, audio tapes, slides, software, and printed materials). Currently this network is located at all NASA Field Centers and in 36 states serving over 90,000 teachers nationwide. These centers, formed through a Space Act Agreement between a NASA Center and a non-profit educational entity (e.g., a school, university, museum, or planetarium), provide a national network for education program information and materials dissemination—a capability that is unique among mission agencies.

In the Higher Education Branch of the Education Division, the National Space Grant College and Fellowship Program ("Space Grant") was designed to maintain the Nation's preeminence in aeronautics, space science, and technology. Under the Space Grant Program, a national network of

academic institutions, industry affiliates, and state and local government and non-profit institutions has been formed. Space Grant programs have been established in every state as well as in the District of Columbia and Puerto Rico. Each of these consortia receives NASA funds to conduct balanced programs of research, education, and public service (education outreach).

In 1991, the 52 consortia, representing more than 300 academic institutions (including 26 Historically Black Colleges and Universities, 25 "other minority institutions," and approximately 20 community colleges), awarded 1,175 fellowships, divided between undergraduate and graduate students. Of this number, 19 percent were awarded to members of underrepresented minority groups and 34 percent to women. There were more than 300 elementary/secondary and other public outreach programs supported by Space Grant consortia. Also during this year, many interdisciplinary courses and programs were introduced, along with other avenues of curricular reform. In the area of research infrastructure, many small research grants were awarded to faculty and students, faculty release time was granted, and conferences were held to study new potential research areas.

Anecdotal evidence of program success abounds. The Pennsylvania Space Grant Consortium helped develop a TV sequence which has reached seven million children. The Hawaii Space Grant Program leveraged two tenure track faculty positions from their state legislature. The Virginia Space Grant Program ran a successful competition for a student-designed program to plan the National Aerospace Plane. Though relatively new, the Space Grant Program is achieving significant educational outreach success.

Through the Teacher Resource Center Network and the National Space Grant College and Fellowship Program, NASA is building a national infrastructure for program information dissemination. This infrastructure represents a significant part of NASA's plan to reach and leverage its programs and materials to a broader segment of the education community. Through the following objectives, we will continue to expand and strengthen this network until NASA has a physical presence in every state.

Objective: Expand the Teacher Resource Center Network to include at least one NASA Teacher Resource Center (TRC) in each state.

Milestone: FY 1994 - Establish at least one TRC in each of the 14 states not currently being served.

Objective: Refine and enhance the National Space Grant College and Fellowship Program.

Milestones: FY 1993 - Develop five Regional Space Grant Consortia to share program successes and to develop educational and research opportunities from a geographical perspective.



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FY 1993 - Develop an effective electronic communications system for sharing program innovations and successes among the Consortia members.

FY 1995 - Establish a foundation for an extension component to Space Grant, similar to that of Land and Sea Grant Programs. (To be done in consultation with the U.S. Department of Agriculture and the National Oceanic and Atmospheric Administration)

Electronic Delivery Systems

A physical presence in each state cannot reach all students and teachers. However, with educational technologies such as satellite communications and on-line computer information systems, every school, no matter how remote, can have immediate access to NASA information and educational materials. In expanding NASA's educational delivery systems for both follow-up activities and to serve those educators not reached through direct participation programs, various electronic delivery systems have been established over the past five years.

For example, NASA produces videoconferences for precollege teachers each year. These in-service videoconferences are received by approximately 2,000 registered educational sites in all 50 states, Canada, and Mexico. In addition, NASA Select, NASA's internal communications television system, includes a segment of educational programming each day, as well as Space Shuttle mission coverage and public science literacy programming. Through Spacelink, NASA's on-line computer information system, educators can receive aerospace-related news releases, technical reports, summaries of space missions, and educational teacher guides, lesson plans, and software.

NASA also participates in the Federal Information Exchange System (FEDIX), a project begun by the Department of Energy. FEDIX is an on-line information service that links the higher education community and the Federal Government, facilitating research, education, and services. The system provides accurate and timely Federal agency information on topics such as: new funding opportunities for specific research and education activities; excess Government research equipment; minority assistance research and education programs; and scholarships, fellowships, and grants. This project now includes over 12 Federal departments and agencies.

Printed and electronic publications are still required to supplement the curriculum taught by teachers in their schools. Therefore, NASA produces education publications ranging from teacher guides, videotapes, and educational software to CD-ROM (Compact Disc-Read Only Memory) products and video discs. Teachers learn of the availability of these materials through professional conferences, workshops, NASA Spacelink, videoconferences, newsletters, NASA Select, and the NASA Teacher

Resource Center Network. In addition, all printed and computer based materials are available electronically through NASA Spacelink.

To increase the availability of NASA supplementary curriculum materials, the Education Division has developed a three-component dissemination strategy for materials which includes:

1. NASA Spacelink as the mechanism for the electronic dissemination of text and graphics;

2. NASA Select for the dissemination of videos; and

3. The NASA Teacher Resource Centers for on-site acquisition of materials by teachers.

The NASA Strategic Plan for Education includes specific objectives to expand and enhance this dissemination network to better serve the Nation's educators.

Objective: Enhance NASA Spacelink by providing toll-free access via computer networks and implementing additional computer communications capabilities.

Milestones: FY 1992 - Implement Spacelink Internet access. (Completed: October, 1991)

FY 1993 - Establish toll-free telephone networks to supplement Internet access.

Objective: Enhance the technological capabilities of the Teacher Resource Center Network.

Milestone: FY 1994 - Begin upgrading TRC equipment to include modern educational technologies such as computers, multimedia systems, and computer network systems.

Objective: Expand NASA Select by including a designated educational program period of approximately one-hour per school-day and making Select available to other education networks such as the Cable Alliance for Education and the U.S. Department of Education's Star Schools program.

Milestone: FY 1993 - Implement daily segment of educational programming.

FY 1993 - Inform educational organizations, networks, and teachers of NASA Select programming.

FY 1993 - Produce and distribute a monthly program guide via NASA Spacelink and other educational channels.

Objective: Maintain and support FEDIX.

Milestone: FY 1993 - Review a proposal for on-line submission of grant proposals and make a funding decision.

High-Leverage Activities

The NASA Field Centers, the Teacher Resource Center Network, Space Grant Consortia, and satellite and on-line computer systems are excellent mechanisms for the dissemination of education services and information. However, there are limits to what NASA can directly accomplish. Therefore, NASA is taking additional steps to develop high-leverage educational projects to support the national education reform movement through partnerships with public and private organizations.

Initiated by NASA in late 1990, the Agency's role in the Tri-State Education Initiative (TSEI) will be the facilitator or catalyst for promoting and supporting the innovative efforts of communities in a 50-mile radius area in Alabama-Mississippi-Tennessee to develop a quality education system—a system that will permit their citizens to obtain the necessary skills for gainful employment in America's high-technology economy. Working in cooperation with other Federal, state, local, and private organizations, a 29-member consortium of school systems has been established within the 9,800 mile, eight county area. This effort is directed at accomplishing the National Education Goals and the AMERICA 2000 strategy by facilitating systemic change in the 220 schools in the area. Designed as a potential adaptive model, program implementation is underway, enthusiastic community involvement and support has been generated, and the underserved educational systems are initiating meaningful systemic change.

Another example of NASA's effort to leverage its activities to a broader segment of the educational community is the significant support it has provided to national education conventions. During FY 1992, NASA significantly supported four major conventions: (1) the National Science Teachers Association (NSTA), (2) the National Council for Teachers of Mathematics (NCTM), (3) the National Congress on Aviation and Space Education (NCASE), and (4) the International Technology Education Association (ITEA). At the NSTA Convention, which draws approximately 19,000 science educators from throughout the Nation, NASA sponsored 24 exhibits to expose teachers and college faculty to NASA research and development activities. All exhibits provided educators teaching material that can be used with their classes. One exhibit, for example, featured "ask an astronomer" where astronomers from the NASA science community were available for one-to-one discussions with teachers. In addition, 16 NASA scientists and educational specialists presented teacher workshops to science

educators covering such topics as: The Great Observatories in Space Astronomy, Space Physics, Aeronautics, and Space Exploration. A similar level of support was provided to the other national convention sites. NASA plans to continue this effort in FY 1993-1994. Underlying all aspects of this activity was the dissemination of information to educators on accessing NASA educational resources and information.

To leverage NASA's impact on a broader segment of the education community, numerous initiatives have been undertaken in the past two years. In cooperation with a group of its major private sector contractors, the NASA-Industry Education Initiative (NIEI) began in FY 1991 as a voluntary coopérative effort for accomplishing the National Education Goals by the year 2000. Aligned with the FCCSET/CEHR priorities, the first "Education Programs Report," was released in July, 1992. The report inventories programs of the 26 NASA contractor participants which support American education at all levels. The study found: (a) 581 identifiable programs being supported; (b) financial support by the participants totaling over $100 million; and (c) 4.8 million participants in these programs. This effort will be continued and expanded during FY 1992-1993 to further support the national reform movement.

NASA will continue to pursue high-leverage educational activities and to expand and strengthen partnerships in order to make the broadest possible impact on the national education reform movement through the following objectives.

Objective: Establish a NASA-funded position with professional organizations responsible for developing curriculum standards in science.

Milestone: FY 1993 - Provide funding to the National Research Council to ensure that NASA programs are in concert with the national science standards currently under development.

Objective: In collaboration with the leadership of major educational associations (e.g., NSTA, NCTM, ITEA), continue to expand NASA's presence at annual national conventions.

Milestone: FY 1993 - Introduce an innovative presentation format to demonstrate aerospace science, mathematics, and technology activities for teachers at the NSTA, NCTM, and ITEA conventions.

Objective: Initiate the NASA Industry Education Initiative (NIEI) to coordinate industry education programs with NASA's.

Milestone: FY 1992 - Produce and disseminate the first NIEI report. (Completed: July 1992)

FY 1993 - Regularly meet with the NIEI Working Group to share information and disseminate program information.

FY 1993 - Commence activities recommended in the initial NIEI report.

Objective: Implement the Tri-State Education Initiative as a benchmark program for federal collaborative efforts with local school personnel to implement the National Education Goals.

Milestone: FY 1992 - Implement a NASA Teacher Resource Center for use by educators in the area. (Completed: October 1991)

FY 1992 - Employ a NASA program director and support personnel to manage the Agency's education program in the Tri-State region. (Completed: January 1992)

FY 1993 - Develop an advanced computer communications network as requested by the local schools.

Objective: Establish a Volunteer Precollege Outreach Program in partnership with the American Institute for Aeronautics and Astronautics (AIAA).

Milestones: FY 1993 - Convene a workshop composed of a task group of experts to outline an implementation manual for school presentations.

FY 1993 - Produce and distribute a "How-to Guide" for elementary and secondary education programs.

Objective: Foster partnerships with schools, museums, civic groups, and similar organizations through loans of exhibits, NASA hardware, and other educational materials

Milestone: FY 1993 - Continued discussion and cooperation on collaborative efforts with the Association of Science and Technology Centers.

## IV. CONCLUSION

NASA has taken significant actions over the past years to coordinate and disseminate educational information among its facilities and within the education community. In addition to direct interaction between educators and personnel at the Field Centers, NASA provides information, materials, and services to the larger education community through a three-part dissemination strategy which includes: a physical presence in every state

through the Teacher Resource Center Network and the Space Grant program; electronic delivery systems such as satellite videoconferences, NASA Select, NASA Spacelink, and FEDIX; and high-leverage activities through partnerships with other educational, industrial, and non-profit associations. By successfully utilizing this effective distribution network, NASA will have a genuine impact on the national education reform movement.

When the Strategic Plan for Education is completed in November 1992, it will outline the standards by which NASA will measure its education program, including an expanded plan for the dissemination of program information, products, and services. By leveraging NASA's unique resources—its facilities and personnel—we are using NASA's inspiring mission as a vehicle for teaching and for learning. As a Federal agency with a vested interest in the nation's scientific and technological health, the educational health of this Nation is not only an opportunity for NASA, it is an obligation.

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